
*With best wishes,
Jim Ratter*

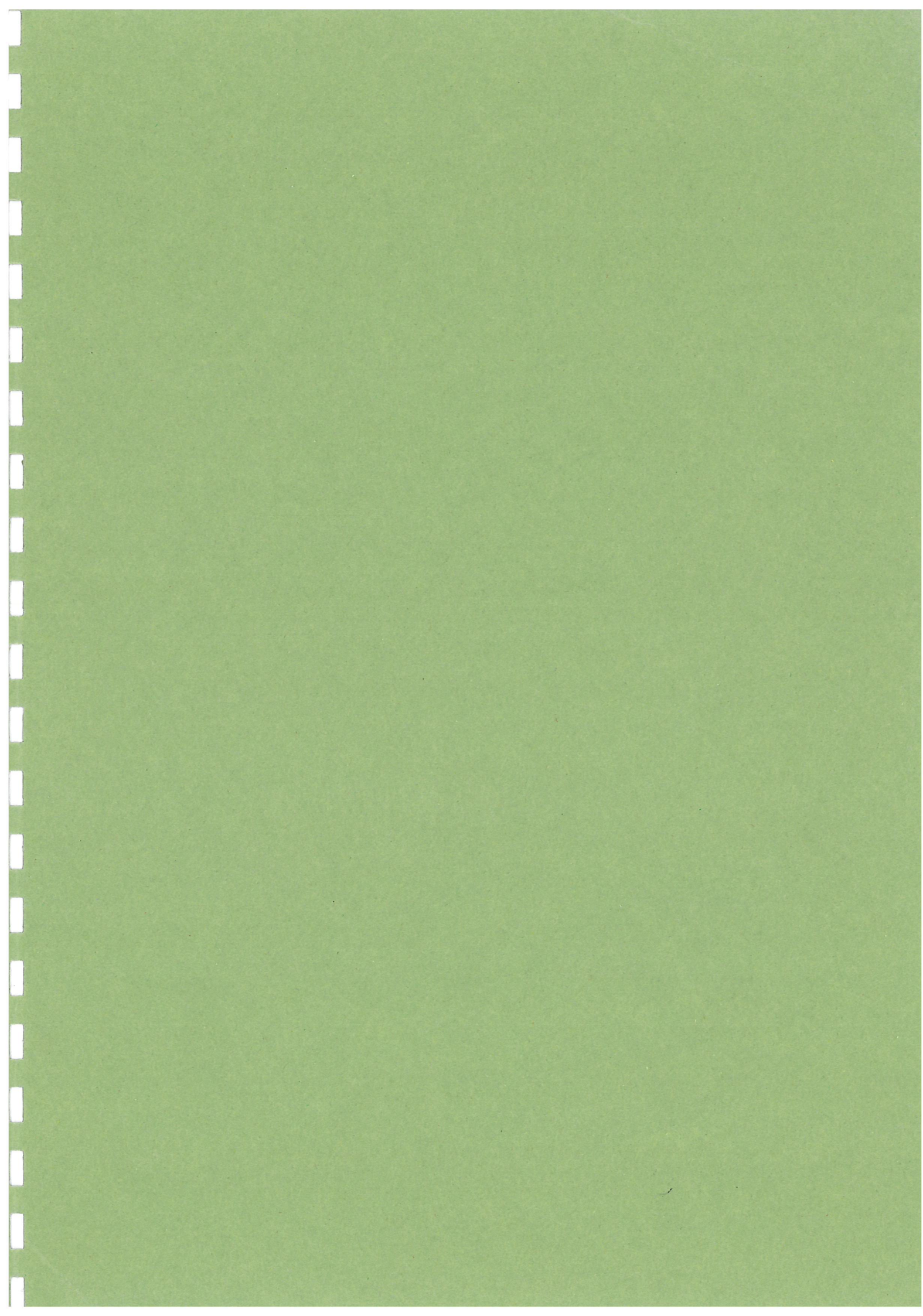
NOTES ON THE VEGETATION OF FAZENDA AGUA LIMPA

(BRASÍLIA, DF, BRASIL)

Including a key to the woody genera of
dicotyledons of the cerrado

J.A. RATTER

ROYAL BOTANIC GARDEN, EDINBURGH



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MAP 1

FAZENDA AGUA LIMPA

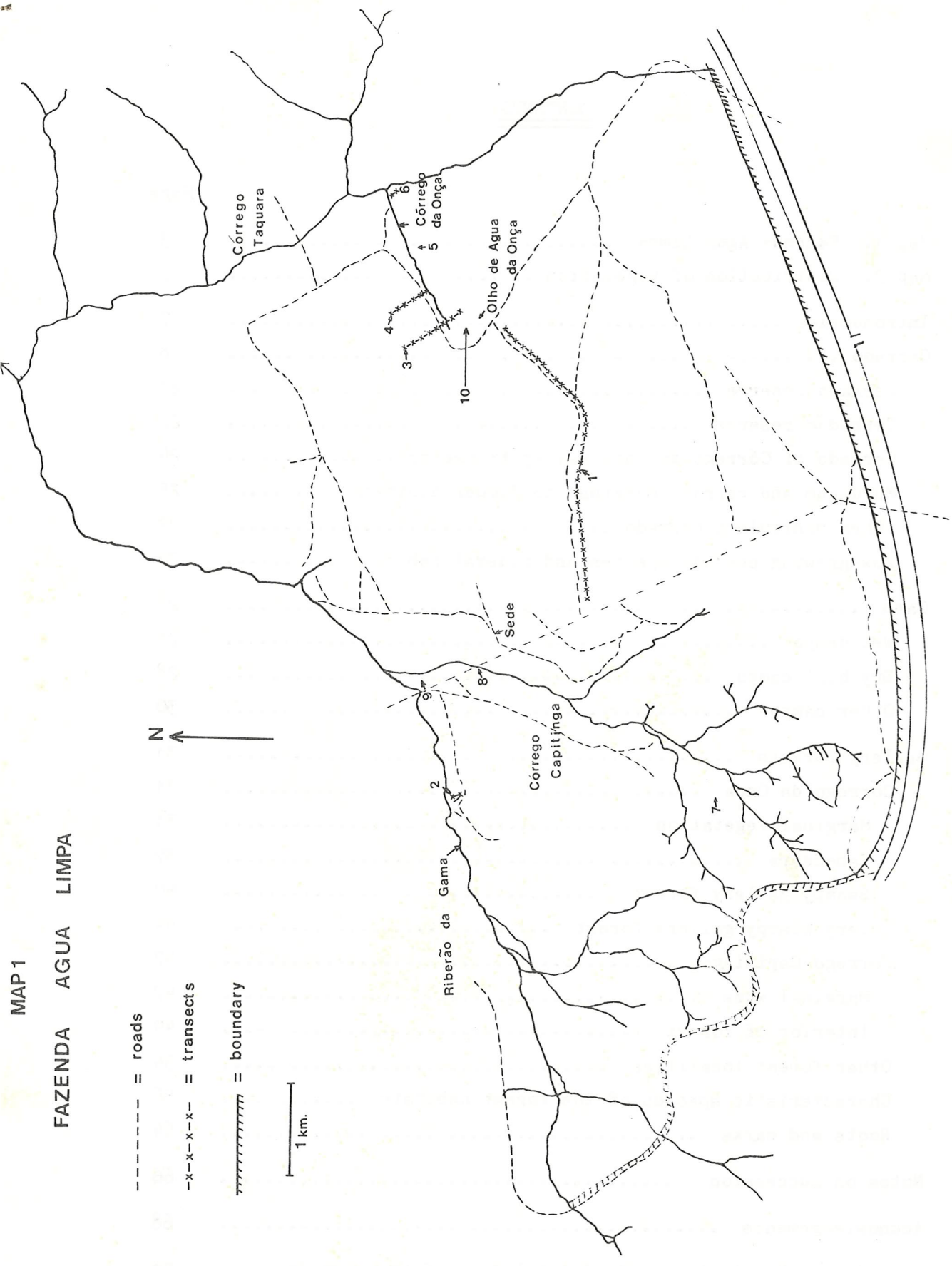
----- = roads

-x-x-x-x- = transects

~~~~~ = boundary

1 km.

N



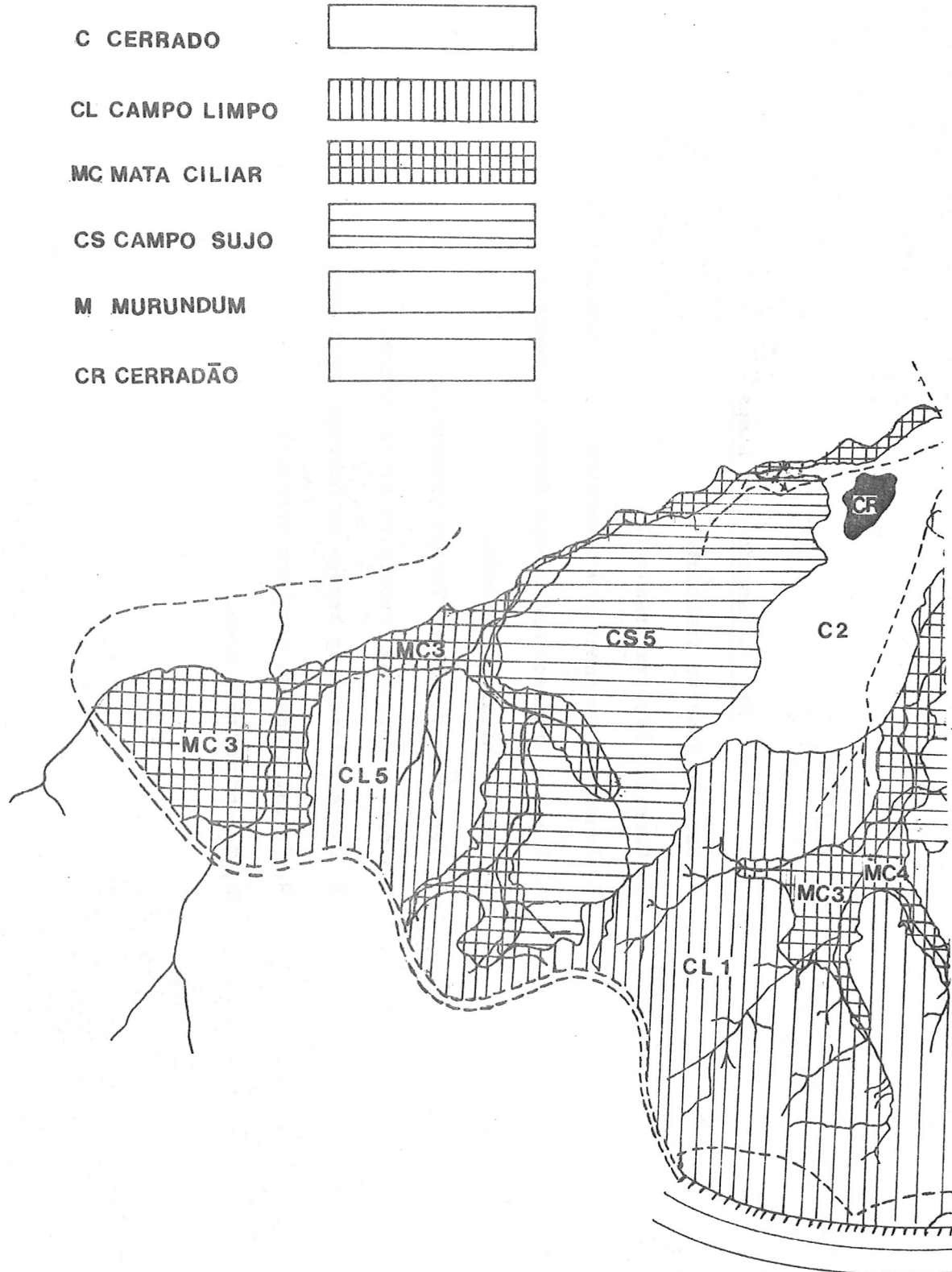


Map 1. Fazenda Agua Limpa

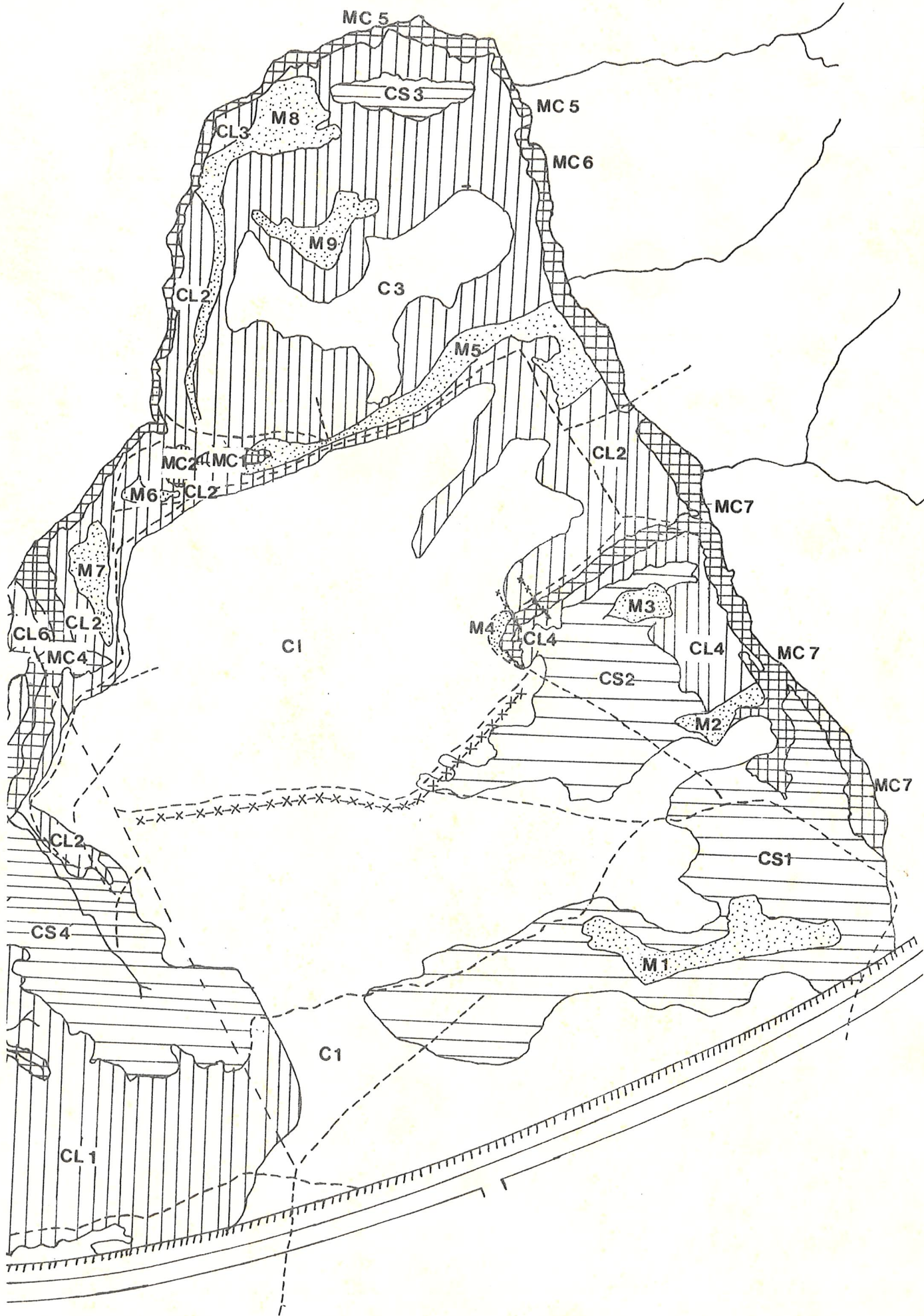
- 1, Cerrado Reserve transect.
- 2, Cerradão Reserve transect.
- 3, Ernesto's transect and cabeceira forest transect 3.
- 4, Peter's transect and swampy forest transect 1.
- 5, Luhea paniculata cerrado.
- 6, Very swampy gallery forest transect 2.
- 7, Córrego Capitinga cabeceira study square.
- 8, Gallery forest by bridge on Córrego Capitinga.
- 9, Forest close to northern entrance.
- 10, Murundum study area.

## MAP 2

### DISTRIBUTION OF VEGETATION (PREPARED BY UnB ECOLOGY MESTRADO COURSE 1979)









## INTRODUCTION

The following account represents some of the results of a vegetation survey of Fazenda Agua Limpa carried out in 1976 as a part of the first phase of the research programme of the Ecology Laboratory of the University of Brasília. Some additional data obtained during a visit in 1978 have also been incorporated.

The Fazenda of 4,062 hectares is sited with its sede approximately 18 km to the SW of the Brasília Rodoviária and has been owned by the University of Brasília since the early 1960s. Map 1, p.3, shows the various localities on the Fazenda, while Map 2, p.5&6, produced by the 1979 mestrado course in ecology, plots the distribution of vegetation. The majority of the Fazenda has suffered little human disturbance, apart from burning, and is thus particularly well-suited for the establishment of an ecological reserve. Since the preliminary work reported here was carried out a modern field laboratory has been built close to the sede and measures taken to improve protection of the vegetation from fires and other disturbance.

This paper is intended as a provisional guide to the vegetation and is arranged in a form which hopefully allows easy reference. Clearly the work could be much condensed but in so doing accessibility of information would be reduced. For instance, it would be possible to convey the data presented in the existing 18 tables in one giant all-encompassing table, but extraction of information to provide species lists for individual communities would then become much more laborious. The present rather lengthy format coupled with an inexpensive mode of publication has therefore been adopted. It is intended that the work should be translated into Portuguese in the near future.

Tables 1 (pp.9-13), 2 (pp.15-20), 6 (pp.29-30) and 18 (pp.58-64) can be used as checklists (of varying completeness) to cerrado trees and large shrubs, cerrado herbs and small shrubs, campo, and forest vegetation respectively. The species in these tables are given in family order to facilitate use by students working on projects on the Fazenda: generally they will identify the family first and thus an arrangement grouping species under families greatly speeds reference. In some cases where identification to species or genus has not been made a collecting number is given; specimens of all collections made on Fazenda Agua Limpa and covering almost all the species mentioned in the text are lodged in the herbarium of the University of Brasília (UB).

It is hoped that the very incomplete outline presented here will be useful in providing a basis on which more detailed work can be developed. Much of even the most basic work, such as collecting, remains to be done and it is hoped that in the coming years knowledge of the Fazenda will be continually updated as a result of the studies of research teams working there.



## CERRADO

Cerrado vegetation in its various forms, ranging from sparse campo sujo to tall cerradão, is the dominant vegetation of Fazenda Agua Limpa, although campo limpo covers considerable areas, including the higher ground towards the railway in the east. Detailed surveys by means of transects have been made in the main cerrado reserve, in the cerradão reserve situated on the land running down to the Ribeirão de Gama, and on two transects running across the valley of the Córrego da Onça (see map 1). The results of these, together with more general observation and collecting throughout the Fazenda, form the basis of the account which follows.

Species lists for (a) trees and large shrubs, and (b) herbs and small shrubs are given in Tables 1 and 2. They cover all species collected, or observed, during the surveys in cerrado vegetation sensu lato and estimates of frequency based on transect data are given in some cases. The list for trees and larger shrubs (Table 1) is fairly complete but that of the smaller plants (Table 2) is much less exhaustive, although it is hoped that it includes the majority of common and important species.

Following the general lists in Tables 1 and 2, the individual areas and communities studied are discussed.

Table 1

Trees and large shrubs of the cerrado s.l.  
(species attaining 2 m or more in height and/  
or 3 cm d.b.h.)

Frequency symbols: a, abundant; c, common; f, frequent;  
o, occasional; r, rare; vr, very rare.

\*Rare species observed in other cerrado habitats on the  
Fazenda but not in the main study areas.

|                                                   | Cerrado<br>Reserve | Cerradão<br>Reserve | Córrego da<br>Onça Valley<br>transects | Luhea<br>paniculata<br>cerrado |
|---------------------------------------------------|--------------------|---------------------|----------------------------------------|--------------------------------|
| <u>Annonaceae</u>                                 |                    |                     |                                        |                                |
| <i>Annona crassiflora</i> Mart.                   | vr                 | r                   | -                                      | o                              |
| <i>Xylopia aromatica</i> Lam.                     | -                  | r                   | -                                      | -                              |
| <u>Apocynaceae</u>                                |                    |                     |                                        |                                |
| <i>Aspidosperma macrocarpon</i> Mart.             | f                  | c                   | -                                      | -                              |
| <i>A. tomentosum</i> Mart.                        | c                  | a                   | f                                      | -                              |
| <i>Hancornia speciosa</i> Gomez                   | r                  | r                   | -                                      | -                              |
| <u>Araliaceae</u>                                 |                    |                     |                                        |                                |
| <i>Didymopanax macrocarpum</i><br>(C. & S.) Seem. | c                  | a                   | a                                      | f                              |
| <u>Bignoniaceae</u>                               |                    |                     |                                        |                                |
| <i>Tabebuia caraiba</i> (Mart.) Bur.              | r                  | o                   | o                                      | o                              |
| <i>T. ochracea</i> Cham.                          | o                  | r                   | -                                      | -                              |
| <u>Bombacaceae</u>                                |                    |                     |                                        |                                |
| <i>Bombax longiflorum</i> K. Schum.               | -                  | -                   | vr                                     | c                              |
| <i>B. martianum</i> K. Schum.                     | -                  | -                   | -                                      | r                              |
| <i>B. tomentosum</i> St. Hil.                     | o                  | o                   | f                                      | c                              |
| <u>Caryocaraceae</u>                              |                    |                     |                                        |                                |
| <i>Caryocar brasiliense</i> Camb.                 | c                  | c                   | -                                      | -                              |
| <u>Celastraceae</u>                               |                    |                     |                                        |                                |
| <i>Plenckia populnea</i> Reiss.                   | f                  | r                   | c                                      | c                              |
| <u>Chrysobalanaceae</u>                           |                    |                     |                                        |                                |
| <i>Couepia grandiflora</i> Benth.                 | vr                 | -                   | -                                      | -                              |
| <i>Licania humilis</i> C. & S.*                   | -                  | -                   | -                                      | -                              |
| <u>Combretaceae</u>                               |                    |                     |                                        |                                |
| <i>Terminalia argentea</i> Mart.<br>& Zucc.       | -                  | -                   | -                                      | c                              |



Table 1 (cont.)

|                                           | Cerrado<br>Reserve | Cerradão<br>Reserve | Córrego da<br>Onça Valley<br>transects | Luhea<br>paniculata<br>cerrado |
|-------------------------------------------|--------------------|---------------------|----------------------------------------|--------------------------------|
| <u>Compositae</u>                         |                    |                     |                                        |                                |
| Eremanthus glomerulatus Less.             | f                  | f                   | c                                      | -                              |
| Piptocarpha rotundifolia<br>(Less.) Baker | f                  | c                   | r                                      | -                              |
| Vernonia ferruginea Less.*                | -                  | -                   | -                                      | -                              |
| <u>Connaraceae</u>                        |                    |                     |                                        |                                |
| Connarus fulvus Planch.                   | c                  | o                   | f                                      | -                              |
| Rourea induta Planch.                     | c                  | -                   | f                                      | f                              |
| <u>Dilleniaceae</u>                       |                    |                     |                                        |                                |
| Curatella americana L.*                   | -                  | -                   | -                                      | -                              |
| Davilla elliptica St. Hil.                | f                  | o                   | f                                      | -                              |
| <u>Ebenaceae</u>                          |                    |                     |                                        |                                |
| Diospyros hispida DC.                     | r                  | o                   | o                                      | -                              |
| <u>Erythroxylaceae</u>                    |                    |                     |                                        |                                |
| Erythroxylum suberosum St. Hil.           | f                  | f                   | o                                      | o                              |
| E. tortuosum Mart.                        | c                  | o                   | o                                      | r                              |
| <u>Euphorbiaceae</u>                      |                    |                     |                                        |                                |
| Pera glabrata (Schott.) Baill.            | -                  | vr                  | -                                      | -                              |
| <u>Flacourtiaceae</u>                     |                    |                     |                                        |                                |
| Casearia grandiflora Camb.                | -                  | o                   | -                                      | -                              |
| <u>Guttiferae</u>                         |                    |                     |                                        |                                |
| Kielmeyera coriacea (Spr.)<br>Mart.       | a                  | o                   | c                                      | -                              |
| K. speciosa St. Hil.                      |                    |                     |                                        |                                |
| <u>Hippocrateaceae</u>                    |                    |                     |                                        |                                |
| Salacia crassifolia (Mart.)<br>Peyr.      | f                  | r                   | f                                      | o                              |
| <u>Icacinaceae</u>                        |                    |                     |                                        |                                |
| Emmotum nitens (Benth.) Miers             | -                  | c                   | -                                      | -                              |
| <u>Lauraceae</u>                          |                    |                     |                                        |                                |
| Nectandra lanceolata Nees                 | -                  | o                   | -                                      | -                              |

Table 1 (cont.)

|                                                  | Cerrado<br>Reserve | Cerradão<br>Reserve | Corrego da<br>Onça Valley<br>transects | Luhea<br>paniculata<br>cerrado |
|--------------------------------------------------|--------------------|---------------------|----------------------------------------|--------------------------------|
| <u>Leguminosae, Caesalpinoideae</u>              |                    |                     |                                        |                                |
| <i>Copaifera langsdorfii</i> Desf.               | r                  | f                   | -                                      | -                              |
| <i>Hymenaea martiana</i> Hayne                   | o                  | r                   | -                                      | -                              |
| <i>Sclerolobium aureum</i> (Tul.)<br>Benth.      | c                  | c                   | a                                      | -                              |
| <i>S. sp.</i> R3824*                             | -                  | -                   | -                                      | -                              |
| <u>Leguminosae, Mimosoideae</u>                  |                    |                     |                                        |                                |
| <i>Dimorphandra mollis</i> Benth.                | o                  | f                   | -                                      | r                              |
| <i>Enterolobium ellipticum</i><br>Benth.         | o                  | o                   | r                                      | o                              |
| <i>Mimosa clausenii</i> Benth.                   | c                  | f                   | o                                      | -                              |
| <i>Plathymenia reticulata</i> Benth.             | vr                 | c                   | r                                      | -                              |
| <i>Stryphnodendron barbatimao</i><br>Mart.       | c                  | r                   | a                                      | r                              |
| <u>Leguminosae, Papilionatae</u>                 |                    |                     |                                        |                                |
| <i>Andira paniculata</i> Benth.                  | vr                 | -                   | -                                      | -                              |
| <i>Bowdichia virgilioides</i> H.B.K.             | f                  | c                   | r                                      | r                              |
| <i>Dalbergia violacea</i> (Vog.)<br>Malme        | c                  | c                   | r                                      | c                              |
| <i>Machaerium acutifolium</i> Vog.               | -                  | o                   | -                                      | -                              |
| <i>M. opacum</i> Vog.                            | o                  | r                   | o                                      | c                              |
| <i>Platypodium grandiflorum</i><br>Benth.        | -                  | -                   | -                                      | c                              |
| <i>Pterodon pubescens</i> Benth.                 | f                  | f                   | -                                      | -                              |
| <i>Sweetia dasycarpa</i> (Vog.)<br>Benth.        | f                  | o                   | o                                      | -                              |
| <u>Loganiaceae</u>                               |                    |                     |                                        |                                |
| <i>Strychnos pseudoquina</i> St. Hil.            | o                  | r                   | -                                      | -                              |
| <u>Lythraceae</u>                                |                    |                     |                                        |                                |
| <i>Lafoensia pacari</i> St. Hil.                 | f                  | f                   | c                                      | -                              |
| <u>Malpighiaceae</u>                             |                    |                     |                                        |                                |
| <i>Byrsonima coccolobifolia</i><br>(Spr.) Kunth. | o                  | f                   | f                                      | o                              |
| <i>B. crassa</i> Nied.                           | )                  |                     |                                        | r                              |
| <i>B. verbascifolia</i> (Spr.)<br>Kunth.         | ) a                | a                   | a                                      | o                              |
| <i>Heteropterys byrsonimifolia</i><br>Adr. Juss. | -                  | -                   | -                                      | o                              |



Table 1 (cont.)

|                                            | Cerrado<br>Reserve | Cerradão<br>Reserve | Córrego da<br>Onça Valley<br>transects | Luhea<br>paniculata<br>cerrado |
|--------------------------------------------|--------------------|---------------------|----------------------------------------|--------------------------------|
| <u>Melastomataceae</u>                     |                    |                     |                                        |                                |
| Miconia ferruginata (DC.)<br>Cogn.         | f                  | f                   | r                                      | -                              |
| M. pohliana Cogn.                          | c                  | f                   | r                                      | -                              |
| M. rubiginosa (Bonpl.) DC.*                | -                  | -                   | -                                      | -                              |
| <u>Myristicaceae</u>                       |                    |                     |                                        |                                |
| Virola sebifera Aubl.                      | -                  | o                   | -                                      | -                              |
| <u>Myrsinaceae</u>                         |                    |                     |                                        |                                |
| Rapanea guyanensis Aubl.                   | r                  | o                   | r                                      | -                              |
| Weigeltia densiflora Mez*                  | -                  | -                   | -                                      | -                              |
| <u>Myrtaceae</u>                           |                    |                     |                                        |                                |
| Eugenia cf. gamaeana Glaz.<br>(nomen)      | f                  | a                   | -                                      | -                              |
| Myrcia cf. tomentosa (Aubl.)<br>DC.        | -                  | -                   | -                                      | c                              |
| 'Ameixa brava' R3535V                      | -                  | -                   | -                                      | o                              |
| <u>Nyctaginaceae</u>                       |                    |                     |                                        |                                |
| Neea theifera Oerst.                       | c                  | c                   | f                                      | -                              |
| Pisonia noxia Netto                        | o                  | r                   | f                                      | -                              |
| Pisonia sp.                                | o                  | r                   | -                                      | -                              |
| <u>Ochnaceae</u>                           |                    |                     |                                        |                                |
| Ouratea acuminata (DC.) Engl.              | a                  | o                   | c                                      | f                              |
| <u>Opiliaceae</u>                          |                    |                     |                                        |                                |
| Agonandra brasiliensis Miers*              | -                  | -                   | -                                      | -                              |
| <u>Palmae</u>                              |                    |                     |                                        |                                |
| Syagrus comosa (Mart.) Mart.               | f                  | f                   | r                                      | -                              |
| S. flexuosa (Mart.) Becc.                  | f                  | a                   | r                                      | c                              |
| <u>Proteaceae</u>                          |                    |                     |                                        |                                |
| Roupala montana Aubl.                      | c                  | o                   | c                                      | f                              |
| <u>Rosaceae</u>                            |                    |                     |                                        |                                |
| Prunus brasiliensis (C. & S.)<br>D. Dietr. | vr                 | -                   | -                                      | -                              |

Table 1 (cont.)

|                                        | Cerrado<br>Reserve | Cerradão<br>Reserve | Córrego da<br>Onça Valley<br>transects | Luhea<br>paniculata<br>cerrado |
|----------------------------------------|--------------------|---------------------|----------------------------------------|--------------------------------|
| <u>Rubiaceae</u>                       |                    |                     |                                        |                                |
| Ferdinandusa elliptica Pohl            | vr                 | vr                  | -                                      | -                              |
| Palicourea rigida H.B.K.               | c                  | o                   | f                                      | -                              |
| Rudgea viburnioides (Cham.)<br>Benth.* | -                  | -                   | -                                      | -                              |
| Tocoyena formosa (C. & S.)<br>K. Sch.  | f                  | r                   | o                                      | -                              |
| <u>Rutaceae</u>                        |                    |                     |                                        |                                |
| Fagara rhoifolia (Lam.) Engl.          | -                  | r                   | -                                      | -                              |
| <u>Sapotaceae</u>                      |                    |                     |                                        |                                |
| Pouteria ramiflora (Mart.)<br>Radlk.   | c                  | r                   | r                                      | -                              |
| P. torta (Mart.) Radlk.                | o                  | vr                  | -                                      | -                              |
| <u>Simarubaceae</u>                    |                    |                     |                                        |                                |
| Simaruba amara Aubl.*                  | -                  | -                   | -                                      | -                              |
| <u>Solanaceae</u>                      |                    |                     |                                        |                                |
| Solanum crinitum Lam.*                 | -                  | -                   | -                                      | -                              |
| <u>Styracaceae</u>                     |                    |                     |                                        |                                |
| Styrax ferrugineus Nees &<br>Mart.     | f                  | o                   | c                                      | f                              |
| <u>Symplocaceae</u>                    |                    |                     |                                        |                                |
| Symplocos rhamnifolia A.DC.            | r                  | r                   | f                                      | o                              |
| <u>Tiliaceae</u>                       |                    |                     |                                        |                                |
| Luhea paniculata Mart.                 | -                  | -                   | -                                      | c                              |
| <u>Velloziaceae</u>                    |                    |                     |                                        |                                |
| Vellozia squamata Pohl                 | o                  | f                   | f                                      | -                              |
| <u>Verbenaceae</u>                     |                    |                     |                                        |                                |
| Aegiphila lhotskyana Cham.*            | -                  | -                   | -                                      | -                              |

Table 1 (cont.)

|                                        | Cerrado<br>Reserve | Cerradão<br>Reserve | Córrego da<br>Onça Valley<br>transects | Luhea<br>paniculata<br>cerrado |
|----------------------------------------|--------------------|---------------------|----------------------------------------|--------------------------------|
| <u>Vochysiaceae</u>                    |                    |                     |                                        |                                |
| Callisthene major Mart.                | -                  | r                   | -                                      | -                              |
| Qualea grandiflora Mart.               | a                  | a                   | o                                      | c                              |
| Q. multiflora Mart.                    | f                  | f                   | o                                      | f                              |
| Q. parviflora Mart.                    | a                  | a                   | f                                      | f                              |
| Salvertia convallariodora<br>St. Hil.* | -                  | -                   | -                                      | -                              |
| Vochysia elliptica (Spr.)<br>Mart.     | c                  | r                   | r                                      | -                              |
| V. rufa (Spr.) Mart.                   | vr                 | -                   | -                                      | r                              |
| V. thyrsoidea Pohl                     | o                  | o                   | c                                      | -                              |



Table 2

Herbs and small shrubs of the cerrado s.l. (and dry campo limpo)

A few species included in Table 1 are also listed here since although they occasionally attain 2 m in height and/or 3 cm d.b.h. they are more characteristically of smaller size.

Some of the species are much more characteristic of very open campo sujo, or campo limpo, and these are marked with an asterisk.

1, 2 = species noted as common in Cerrado and Cerradao Reserves respectively.

Acanthaceae

- Justicia lanstyakii* Rizz.
- Ruellia asperula* (Mart. & Nees)  
Lindan
- R. hapalatricha* Lindan
- R. cf. villosa* (Nees) Pohl
- Stenandrium pohlii* Nees

Amaranthaceae

- Gomphrena lanigera* Pohl
- G. officinalis* Mart. 1
- Pfaffia denudata* (Moq.) Ktze

Amaryllidaceae

- Alstroemeria cuneata* Vell. 2

Anacardiaceae

- Anacardium curatellifolium* St.  
Hil. 1

Annonaceae

- Annona monticola* Mart. 1, 2
- A. tomentosa* R.E. Fr. 1, 2
- A. pygmaea* Warm.
- Duguetia furfuracea* (St. Hil.)  
Benth. & Hook.

Apocynaceae

- Himatanthus obovata* (M. Arg.)  
Woods. 1, 2
- Macrosiphonia grandiflora* (Desf.)  
M. Arg.
- M. vellame* (St. Hil.) M. Arg.
- Mandevilla illustris* (Vell.)  
Woods. 2
- M. myriophyllum* (Taub) Woods\*

Apocynaceae (cont.)

- M. velutina* (Mart.) Woods.
- Peschiera affinis* Miers ?
- Rhodocalyx rotundifolius* M. Arg.

Asclepiadaceae

- Barjonia erecta* (Vell.) K. Sch.
- B. triangularis* K. Sch.
- Ditassa montana* Decne.
- D. virgata* Fourn.

Bignoniaceae

- Anemopaegma arvensis* (Vell.) Stellf.
- A. glaucum* [Mart. ex] DC.
- Arrabidaea brachypoda* Bur. & K. Sch.  
1, 2
- A. sceptrum* (Cham.) Sandw. 2
- Jacaranda decurrens* Cham. 1, 2
- J. caroba* (Vell.) DC.
- J. rufa* Manso 2
- Memora pedunculata* (Vell.) Miers 1
- Zehyera digitalis* (Vell.) Hoehne

Bromeliaceae

- Bilbergia alfonsi-joannis* Reitz  
2 (epiphyte)
- Dyckea* sp. 1, 2
- Bromelia balansae* Mez.
- B. villosa* Mez. 1, 2

Burseraceae

- Protium ovatum* Engl. 1, 2

Chrysobalanaceae

- Parinari obtusifolia* Hook. f. 1

Table 2 (cont.)

Cochlospermaceae

*Cochlospermum insigne* St. Hil.

Compositae

*Aspilia foliacea* Bak.

*A. platyphylla* (Bak.) Blake

*A. sp.* R2841

*Baccharis humilis* Sch. Bip.

*B. subcapitata* Gardn.

*B. subdentata* DC.

*Bidens graveolens* Gardn.

*Chaptalia integerrima* (Vell.) Benth.

*Calea cuneifolia* DC.

*C. hymenolepis* Bak.

*C. rotundifolia* Bak. (= *Brasilia sickii* Barroso)

*Eremanthus scapigerus* Bak.\*

*E. sphaerocephala* (DC.) Bak.

*Eupatorium amygdalinum* Lam.

*E. spp.*

*Ichthyothere latifolia* Bak. 2

*Lychnophora ericoides* Mart.\*

*Mikania sessilifolia* DC.

*Riencourtia oblongifolia* Gardn.

*Stevia heptachaeta* DC.

*Trixis glutinosa* D. Don

*T. picroides* Gardn.

*T. verbasciformis* Less.

*Vernonia barbanoides* Less.

*V. dura* Mart.

*V. elegans* Gardn.

*V. erythrophylla* DC.

*V. ferruginea* Less. (disturbed habitats)

*V. fruticulosa* Mart.

*V. herbacea* (Vell.) Rusby

*V. megapotamica* Spreng.

*V. virgulata* Mart.

*Viguiera grandiflora* Gardn.

*V. kunthiana* Gardn.

*C. robusta* Gardn. 2

Connaraceae

*Rourea induta* Planch. 1

Convolvulaceae

*Evolvulus lagopodioides* Meissn.

*Ipomaea aturensis* G. Don.

*I. squamisepala* O'Donnell

*I. tomentosa* (Choisy) Hallier

Cyperaceae

*Bulbostylis emmerichiae* T. Koyama\*

*B. paradoxa* (Spreng.) Standl.

*B. sp.* R4042

*Rhynchospora consanguinea* Boeck.  
var. *rigida* (Kunth) Kukenthal  
1, 2

*R. exaltata* Kunth

*R. patuligluma* C.B. Clarke

*R. terminalis* (Nees) Steudel\*

*R. warmingii* Boeck\*.

Erythroxylaceae

*Erythroxylum campestre* St. Hil.  
1, 2

*E. deciduum* St. Hil. 1

*E. tortuosum* Mart. 1, 2

Euphorbiaceae

*Croton goyazensis* Muell. Arg. 1, 2

*C. pohlianus* Muell. Arg. 1, 2

*C. spp.*

*Dalechampia capernoides* Baill. 1, 2

*Euphorbia coecorum* [Mart. ex] Boiss.

*E. sp.* R4243\*

*Manihot gracilis* Pohl emend. Rogers  
& Appan ssp. *gracilis* Rogers &  
Appan

*Manihot sagittato-partita* Pohl

*Maprounea guianensis* Aubl.  
(incl. *M. brasiliensis* St. Hil.  
see p. )

*Sapium marginatum* Muell. Arg.

*Sebastiania serrulata* (Mart.) Muell.  
Arg. var. *oncoblepharis* Muell.  
Arg.

Table 2 (cont.)

Eriocaulaceae

*Paepalanthus* cf. *speciosus* (Borg.)  
Koern.

Flacourtiaceae

*Casearia sylvestris* Sw. 1, 2

Gentianaceae

*Calolisianthus speciosus* (C. & S.)  
Gilg.  
*Chelonanthus viridiflorus* (Mart.) Gilg.  
*Dejanira nervosa* C. & S.  
*D. pallescens* C. & S.

Gramineae

*Aristida riparia* Trin. 1  
*A. sp.* R2999 1  
*A. sp.* R3011  
*Axonopus barbigerus* (Kunth.) Hitchc. 1  
*Ctenium chapadense* (Trin.) Doell.  
*Echinolaena inflexa* (Poir.) Chase 1, 2  
*Elionurus muticus* (Spreng.) Kuntze\*  
*Eriochrysis holcoides* (Nees) Kuhlms.\*  
*Hyparrhenia rufa* (Nees) Stapf  
*H. bracteata* (Humb. & Bonpl.) Stapf  
*Melinis minutiflora* P. Beauv.  
*Panicum longispiculum* Doell.\*  
*P. macranthum* Trin.\*  
*P. cf. procurrens* 1, 2  
*Paspalum gardnerianum* Nees  
*P. polyphyllum* Nees  
*P. stellatum* Humb. & Bonpl.\*  
*P. trachycoelon* Schrad.  
*Schizachyrium sanguineum* (Retz.) Alst.  
1  
*S. tenerum* Nees  
*Sporobolus cubensis* Hitchc.\*  
*Thrasya petrosa* (Trin.) Chase  
*Trachypogon spicatus* (L. f.) Kuntze 1  
*Tristachya leiostachya* Nees

Guttiferae

*Kielmeyera neriifolia* Camb. 1  
*K. rubiflora* Camb. 1

Hippocrateaceae

*Peritassa campestris* (Camb.)  
A. C. Smith 1

Iridaceae

*Sisyrinchium* cf. *incurvatum* Gardn.  
*S. vaginatum* Spreng.  
*S. sp.* R4269  
*Trimezia juncifolia* (Kl.) Benth.

Labiatae

*Eriope crassipes* Benth.\*  
*Hyptis brachystachys* [Pohl ex]  
Benth.  
*H. crinita* Benth.  
*H. cf. foliosa* [St. Hil. ex] Benth.  
*H. lythroides* [Pohl ex] Benth. 1  
*H. macrantha* [St. Hil. ex] Benth.  
s.l.  
*H. nudicaulis* Benth.  
*H. rugosa* Benth. s.l.  
*H. saxatilis* [St. Hil. ex] Benth. 2  
*H. suaveolens* (L.) Poit\*  
*H. villosa* [Pohl ex] Benth. 1  
*Rhabdocaulon denudatum* (Benth.) Epl.  
*Salvia brevipes* Benth.

Lauraceae

*Cassytha* sp.

Leguminosae, Caesalpinoideae

*Bauhinia dumosa* Benth. 1  
*B. sp.* R3286 1  
*Cassia cathartica* Mart.  
var. *cathartica*  
*C. claussenii* Benth. var. *claussenii*  
1, 2  
*C. crommyotricha* Harms  
*C. cotinifolia* G. Don. var.  
*percoriacea* Irwin & Barneby  
*C. desvauxii* Collad.  
var. *langsdoeffii* (Veg.) Irwin &  
Barneby 1, 2  
*C. imbricans* Irwin & Barneby 1  
*C. orbiculata* Benth.\*  
*C. pohliana* Benth. 1  
*C. rugosa* G. Don 1



Table 2 (cont.)

Leguminosae, Mimosoideae

- Calliandra dysantha* Benth. 1  
*Mimosa clausenii* Benth.  
*M. cf. imbricata* Benth.  
*M. lanuginosa* [Glaz. ex] Burkat 1  
*M. cf. radula* Benth.  
*M. cf. bernalensis* Hassl.  
*M. brachycaulis* Harms.  
*M. sp.* R2854  
*Stryphnodendron platyspicum* Rizz. & Herr.

Leguminosae, Papilionatae

- Aeschynomene paucifolia* Vog.  
*Andira humilis* Mart.  
*Crotalaria sp.* R2796  
*C. sp.* R2807  
*Desmodium platycarpum* Benth.  
*Eriosema congestum* Benth. 1  
*E. crinitum* (H.B.K.) D. Don  
     var. *macrophyllum* Grear. 2  
*E. sp. nr. defoliolatum* Benth.  
*E. rigidum* Benth. 2  
*Galactia crassifolia* (Benth.) Taub.  
*G. grewiaefolia* (Benth.) Taub.\* 1  
*G. peduncularis* (Benth.) Taub.\*  
*G. stereophylla* Harms. 1, 2  
*Indigofera lespedezioides* H.B.K.  
*Lupinus vaginans* Benth.  
*Periandra dulcis* Mart.

Liliaceae

- Similax brasiliensis* Spreng.

Loranthaceae

- Phthirusa ovata* (Pohl) Eichl.  
     (recorded on *Dalbergia violacea*  
     and *Byrsonima sp.*)  
*Psittacanthus robustus* Mart.  
     (recorded on *Qualea grandiflora*)

Lythraceae

- Diplusodon crulsianus* Koehne  
*D. hexander* DC.?  
*D. oblongus* Pohl

Lythraceae (cont.)

- D. villosus* Pohl 1  
*D. sp.* R4176  
*Cuphea cf. spermacoce* St. Hil.  
*C. spp.*

Malpighiaceae

- Banisteriopsis acerosa* (Nied.) Gates  
*B. campestris* (Juss.) Little  
*B. megaphylla* (Adr. Juss.) Gates  
*B. stellaris* (Griseb.) Gates  
*B. variabilis* Gates  
*Brysonima basiloba* Adr. Juss.  
*B. subterranea* Brade & Markgraf  
*B. viminifolia* Adr. Juss.\*  
*Brysonima sp.* R3227  
*Heteropteris byrsonimifolia* Adr. Juss. s.l.  
*H. campestris* Adr. Juss.  
*Peixotoa cordistipula* Adr. Juss. 1  
*Pterandra pyroidea* Adr. Juss.  
*Tetrapteris ambigua* (Adr. Juss.) Nied.

Malvaceae

- Pavonia cf. grandiflora* St. Hil.  
*P. pohlii* Gurke  
*P. rosa-campestris* St. Hil. 1  
*Sida sp.*

Melastomataceae

- Cambessedesia adamantinum* (St. Hil) DC.  
*C. espora* DC.  
*Miconia fallax* DC. 2  
*M. albicans* (Sw.) Triana 2  
*Ossaea congestiflora* (Naud.) Cogn.  
*Pterolepis sp.* R2874\*  
*Trembleya phlogiformis* DC. var.  
     *quinquenervia* Cogn. (murundum and  
     damper places)

Menispermaceae

- Cissampelos ovalifolia* DC. 1, 2

Table 2 (cont.)

Moraceae

*Brosimum gaudichaudii* Trec. 1

Myrsinaceae

*Cybianthus* cf. *detergens* Mart. 2

Myrtaceae

*Campomanesia* cf. *corymbosa* Berg

*Eugenia angustana* Kiaersk.

*E. coriacea* Glaz. (nomen)

*E. klotyschiana* Berg

*E. cf. livida* Berg

*E. pluriflora* DC.

*E. cf. rosea* Barbr. Rodr. (nomen?)

*E. cf. subcorymbosa* Berg

*E. sp.* R3476

*Myrcia* (*Aulomyrcia*) *clausseniana* Berg

*M. cordifolia* Berg

*M. cf. deflexa* (Rich.) DC

*M. dictyophylla* Berg 1, 2

*M. linearifolia* Camb. 1, 2

*M. schottiana* Berg

*M. tomentosa* (Aubl.) DC

*M. sp.* R3569

*Psidium incanescens* [Mart. ex] DC

Nyctaginaceae

*Neea theifera* Oerst. 1, 2

*Pisonia* cf. *psammophila* Mart.

Ochnaceae

*Ouratea floribunda* Engl.

Orchidaceae

*Cyrtopodium* sp. R2983\*

*Epistephium sclerophyllum* Lindley

Oxalidaceae

*Oxalis* sp. R3324 2

Palmae

*Allagoptera* (*Diplothemium*)  
*leucocalyx* (Dr.) O. Ktze 2

*Butia leiospatha* (Mart.) Becc.

Passifloraceae

*Passiflora* cf. *clathrata* Mart.

*P. sp.* R2965

Rhamnaceae

*Crumenaria erecta* Reiss.

Rubiaceae

*Alibertia concolor* (Cham.) K. Schum.

*A. cf. sessilis* (Cham.) K. Schum.

*Borreria brachystemoides* DC.

*B. valerianoides* C. & S.

*B. verticillata* Mey.

*B. spp.*

*Chomelia ribesioides* Benth.

*Declieuxia cordigera* [Mart. & Zucc.  
ex] Schult. & Schult. var.  
*cordigera*\*

*D. fruticosa* (Willd. ex R. & S.)  
O. Ktze 1

*D. oenanthoides* M. Arg.

*Mitracarpus villosus* [Sw.] DC.

*Palicourea rigida* H.B.K. 1, 2

*P. squarrosa* (M. Arg.) Standley  
1, 2

*P. xanthophylla* M. Arg.

*Sabicea brasiliensis* Wernh. 1, 2

Rutaceae

*Esenbeckia pumila* Pohl 1

Sapindaceae

*Serjania erecta* Radlk. 1

*S. cf. caracasana* (Jacq.) Willd.

Scrophulariaceae

*Buchnera juncea* Cham. & Schlecht.

*Esterhazyia splendida* Miq.

Simarubaceae

*Simaba suffruticosa* Engl.

Sterculiaceae

*Buettneria scalpellata* Pohl

*Melochia pyramidata* L.

Table 2 (cont.)

Solanaceae

*Solanum lanigerum* Dunal 2

*S. spp.*

Turneraceae

*Turnera* sp. R3343

Umbelliferae

*Eryngium juncifolium* (Urban) Math.  
& Const.

Velloziaceae

*Pleurostima andersonii* (L. B. Smith  
& Ayensen) N Menezes indet.\*

*Vellozia crassicaulis* [Mart. ex] Schult. f. ?\*

*V. squamata* Pohl 1, 2

Verbenaceae

*Aegiphila lanata* Moldenke

*A. lhotskyana* Cham.

*Amasonia hirta* Benth.

*Lippia lupulina* Cham.

*L. martiana* Schau.

*L. rotundifolia* C. & S.

*L. sericea* Cham.\*

*Stachytarpheta chamissonis* Walp.

*S. gesnerioides* Cham.\*

Vitaceae

*Cissus pinnosa* (Bak.) Planch.

Violaceae

*Ionidium* cf. *ipeacuana* Benth.\*



# Cerrado Reserve

The area studied consists of cerrado on fairly flat ground through which a road runs west for approximately 3 km to the Olho de Agua da Onça (see map 1, no.1).

The cerrado varies in density but there are no areas with complete or almost complete crown cover and in consequence the ground vegetation is everywhere well developed. The taller trees are generally from 5 to 6 m tall but occasional individuals, particularly of such species as Bombax tomentosum and Bowdichia virgilioides, are sometimes much taller. Frequencies for all the tree and large shrub species recorded for the area are given in Table 1, and those noted as abundant, common, and frequent are given in Table 3.

Table 3

Most common tree and large shrub species of the cerrado reserve

a, abundant; c, common; f, frequent

|                                 |   |                                   |   |
|---------------------------------|---|-----------------------------------|---|
| <i>Aspidosperma macrocarpon</i> | f | <i>Palicourea rigida</i>          | c |
| <i>A. tomentosum</i>            | c | <i>Piptocarpha rotundifolia</i>   | f |
| <i>Bowdichia virgilioides</i>   | f | <i>Plenckia populnea</i>          | f |
| <i>Byrsonima crass</i> )        | a | <i>Pouteria ramiflora</i>         | c |
| <i>B. verbascifolia</i> )       |   | <i>Pterodon pubescens</i>         | f |
| <i>Caryocar brasiliense</i>     | c | <i>Qualea grandiflora</i>         | a |
| <i>Connarus fulvus</i>          | f | <i>Q. multiflora</i>              | f |
| <i>Dalbergia violacea</i>       | c | <i>Q. parviflora</i>              | a |
| <i>Didymopanax macrocarpum</i>  | c | <i>Roupala montana</i>            | c |
| <i>Eremanthus glomerulatus</i>  | f | <i>Rourea induta</i>              | f |
| <i>Erthroxylum suberosum</i>    | f | <i>Salacia crassifolia</i>        | f |
| <i>E. tortuosum</i>             | c | <i>Sclerolobium aureum</i>        | c |
| <i>Eugenia cf. gamaeana</i>     | f | <i>Stryphnodendron barbatimao</i> | c |
| <i>Kielmeyera coriacea</i> )    | a | <i>Sweetia dasycarpa</i>          | f |
| <i>K. speciosa</i> )            |   | <i>Syagrus comosa</i>             | f |
| <i>Lafoensia pacari</i>         | f | <i>S. flexuosa</i>                | f |
| <i>Miconia ferruginata</i>      | f | <i>Styrax ferrugineus</i>         | f |
| <i>M. pohliana</i>              | f | <i>Tocoyena formosa</i>           | f |
| <i>Mimosa clausenii</i>         | c | <i>Vochysia elliptica</i>         | c |
| <i>Neea theifera</i>            | c |                                   |   |
| <i>Ouratea acuminata</i>        | a |                                   |   |

The herbs and low shrubs scored as most common in the plots used to sample the area are indicated in Table 2. The low vegetation was, however, studied much less exhaustively than were the trees.

Previous to 1976 the area was burned regularly and there was much charring on the trunks of the trees and evidence of destruction of shoots of saplings. The area is now conserved as an ecological reserve and the last fire occurred in the dry season of 1975; in consequence many saplings are beginning to grow beyond the stage at which they are so vulnerable to fire damage and the vegetation in the past two years has thickened very noticeably. The significance of these changes is discussed briefly on p.67.

### Cerradão Reserve

The cerradão reserve lies some 2.5 km from the cerrado reserve, and forms a band of tall cerrado of rather variable density running along the ground sloping down to the Ribeirão de Gama (see map 1, no.2). It was studied by detailed analysis of a transect running across it and by more general observation and collecting.

The larger trees are usually about 10-12 m tall and provide crown cover which in places reaches 100% but is generally much less, often due to large trees having fallen. Many trees, however, are more than 12 m, and some specimens of Bowdichia virgilioides are particularly tall, attaining heights of nearly 20 m with a narrow, upright form. All tree and large shrub species recorded are given in Table 1 and those scored as abundant, common, or frequent are listed in Table 4; the frequency estimates, however, are based on numbers of individuals and do not give a completely accurate idea of relative importance since some of the more common species are small, whilst others scored as 'frequent' are tall, wide-crowned trees which dominate the vegetation in parts of the area. The following are particularly common as large trees: Eugenia cf. gamaeana, Bowdichia virgilioides, Emmotum nitens, Caryocar brasiliense, and in places Copaifera langsdorfii and Simaruba amara. There are also many, big, venerable-looking specimens of Qualea grandiflora, Dalbergia violacea and Vochysia thyrsoidea. Some other large trees are only occasional or rare, e.g. Nectandra lanceolata and Callisthene major.

Table 4

Most common tree and large shrub species of the cerradão  
a, abundant; c, common; f, frequent; s, generally small; t, tall

|                                 |    |                                 |    |
|---------------------------------|----|---------------------------------|----|
| <i>Aspidosperma macrocarpon</i> | c  | <i>Lafoensia pacari</i>         | fs |
| <i>A. tomentosum</i>            | a  | <i>Miconia ferruginata</i>      | fs |
| <i>Bowdichia virgilioides</i>   | ct | <i>M. pohliana</i>              | fs |
| <i>Byrsonima coccolobifolia</i> | as | <i>Mimosa clausenii</i>         | fs |
| <i>B. crassa</i>                | as | <i>Neea theifera</i>            | cs |
| <i>Caryocar brasiliense</i>     | ct | <i>Plathymenia reticulata</i>   | c  |
| <i>Copaifera langsdorfii</i>    | ft | <i>Pterodon pubescens</i>       | ft |
| <i>Dalbergia violacea</i>       | c  | <i>Piptocarpha rotundifolia</i> | cs |
| <i>Didymonpanax macrocarpum</i> | a  | <i>Qualea grandiflora</i>       | a  |
| <i>Dimorphandra mollis</i>      | f  | <i>Q. multiflora</i>            | fs |
| <i>Emmotum nitens</i>           | ct | <i>Q. parviflora</i>            | as |
| <i>Eremanthus glomerulatus</i>  | fs | <i>Sclerolobium aureum</i>      | c  |
| <i>Erythroxylum suberosum</i>   | fs | <i>Simaruba amara</i>           | ft |
| <i>Eugenia cf. gammaeana</i>    | at | <i>Syagrus comosa</i>           | fs |
|                                 |    | <i>S. flexuosa</i>              | as |
|                                 |    | <i>Vellozia squamata</i>        | fs |

In parts of the cerradão there is a great preponderance of large, senescent trees, many of which are dying and falling. In these areas there is very broken canopy, many fallen trunks and boughs on the floor, and a dense ground cover of low-growing species and young trees. In this respect the vegetation differs from more typical and denser forms of cerradão where crown cover is almost continuous and the ground layer sparse. However, in areas where the broad crowns of the larger trees cast considerable shade there is little ground vegetation: this is particularly the case under *Emmotum nitens* which tends to occur in groups with almost bare soil littered with its fallen fruits below.

Amongst the trees a distinct cerradão element of species not found in more open forms of cerrado is present, e.g. *Emmotum nitens*, *Nectandra lanceolata*, *Callisthene major*, *Casearia grandiflora*, *Simaruba amara* and *Virola sebifera* - all species which are also found in forest. Other species such as *Plathymenia reticulata*, *Copaifera langsdorfii* and *Rapanea guyanensis* are much commoner in cerradão than cerrado. In contrast, *Ouratea acuminata* and *Kielmeyera coriacea* of the smaller tree/large shrub element are abundant in the cerrado reserve but only occur as occasionals in the cerradão (see Table 1 for frequencies of species in cerrado and cerradão).



In the ground vegetation there are also a number of species which are more abundant in the cerradão than they are in the cerrado reserve, e.g. Ichthyothere latifolia, Cybianthus detergens, Miconia albicans and Allagoptera (Diplothemium) leucocalyx - the last in areas where other ground vegetation, which tends to overshadow this little acaulescent palm, is sparse. Other species show the converse and are much more abundant in the cerrado. Species noted as common elements of the ground vegetation are indicated in Table 2.

Considerable disturbance has occurred in parts of the cerradão during the last twelve years as a result of dam-building projects on the Ribeirão de Gama bringing temporary population into the area. Many of the larger trees have been felled for timber (judging from the number of stumps, Bowdichia virgilioides and Emmotum nitens have suffered particularly), 'Gariroba' (Syagrus comosa) has been destroyed for palmitos, and the area subjected to frequent burning. These activities, added to the presence of large numbers of old, dead, and fallen trees, have contributed to the general air of dilapidation. Like the cerrado area previously described, the cerradão is now protected as an ecological reserve and such deleterious activities have ceased.

Another area of cerradão situated on a ridge crest in the north-western part of the fazenda was visited briefly and found to have a flora very similar to that of the cerradão reserve.

#### Cerrado of Córrego da Onça valley transects (Ernesto's & Peter's)

These transects both run across the valley of the Córrego da Onça (map. 1, no. 3 & 4) and are sufficiently similar to be considered together. Ernesto's transect begins on the ridge crest to the north, descends the slope, crosses the gallery forest and stream and climbs the other side of the valley to terminate on the ridge crest to the south; whilst Peter's deals with only half the valley, beginning at the northern ridge crest and ending at the gallery forest. Both transects were chosen primarily for soil studies but the vegetation of the many plots lying along them has also been studied.

The vegetation of Ernesto's transect consists of cerrado on the upper slopes of the valley, damp campo with murundum on the lower slopes and gallery forest (cabeceira) in the bottom. Peter's transect is more complex with cerrado on the upper slope, followed by campo and an area of campo sujo and cerrado lying just outside the gallery forest.

The present section is confined to those parts of the transects which occur in cerrado. Species occurrence and frequency of trees and larger shrubs is given in Table 1; however, the cerrado on the ridge crests and uppermost valley sides is rather different from that lying close to the wet campo and for this reason scoring them together gives a rather distorted picture.

The vegetation of the upper parts of these transects is a rather open cerrado belonging to an ill-defined community which might be termed Vochysia thyrsoidea/Sclerolobium aureum cerrado. The commonest tall trees are Sclerolobium aureum, Didymopanax macrocarpum, and Vochysia thyrsoidea which reach about 12 m in height; the broad, flat-topped crown and the heavy trunk and boughs of the last species give a characteristic appearance to the community. The ground vegetation of this open cerrado is well developed and there are many grass tussocks. The Vochysia thyrsoidea/Sclerolobium aureum community is common in the Federal District, principally on higher ground; it is easily recognizable and the term provides the ecologist with a useful informal category, although it would probably be impossible to define the community precisely on floristic or other characters.

The lower parts of the transects are included in the remarks on murundum and cerrado marginal to communities of damper ground.

#### Murundum and cerrado marginal to damper habitats

Murundum was studied in the campo area around the cabeceira of the Córrego da Onça; while cerrado and campo sujo transitional to wet campo and to gallery forest were studied on five transects along the valley of the same stream (including Ernesto's and Peter's) and also on the edges of the large cabeceira of the Córrego Capitinga.

Table 5 gives the occurrence of tree, shrub and herbaceous species (other than grasses) on 26 murundum hummocks in an area close to the Olho de Água da Onça.

Table 5

Occurrence of species on murundum hummocks

The figures refer to the number of hummocks out of a total of 26 on which the species occur.

Tree and larger shrubs species

(including saplings)

|                                 |    |                                   |   |
|---------------------------------|----|-----------------------------------|---|
| <i>Aegiphila lhotskyana</i>     | 2  | <i>Lafoensia pacari</i>           | 2 |
| <i>Aspidosperma tomentosum</i>  | 2  | Lauraceae                         | 1 |
| <i>Bombax tomentosum</i>        | 3  | <i>Miconia ferruginata</i>        | 1 |
| <i>Brysonima coccolobifolia</i> | 3  | <i>M. pohliana</i>                | 4 |
| <i>B. crassa</i> ?              | 16 | <i>Neea theifera</i>              | 5 |
| <i>B. verbascifolia</i>         | 2  | <i>Ouratea acuminata</i>          | 1 |
| <i>Caryocar brasiliense</i>     | 1  | <i>Palicourea rigida</i>          | 8 |
| <i>Connarus fulvus</i>          | 4  | <i>Pisonia noxia</i>              | 6 |
| <i>Dalbergia violacea</i>       | 5  | <i>Rapanea guyanensis</i>         | 1 |
| <i>Davilla elliptica</i>        | 3  | <i>Roupala montana</i>            | 2 |
| <i>Didymopanax macrocarpum</i>  | 6  | <i>Salacia crassifolia</i>        | 1 |
| <i>Enterolobium ellipticum</i>  | 1  | <i>Stryphnodendron barbatimao</i> | 2 |
| <i>Eremanthus glomerulatus</i>  | 4  | <i>Strychnos pseudoquina</i>      | 1 |
| <i>Erythroxylum suberosum</i>   | 1  | <i>Styrax ferrugineus</i>         | 3 |
| <i>E. tortuosum</i>             | 2  | <i>Symplocos rhamnifolia</i>      | 6 |
| <i>Kielmeyera coriacea</i> )    | 16 | <i>Sweetia dasycarpa</i>          | 8 |
| <i>K. speciosa</i> }            |    |                                   |   |

Herb and low shrub species

(species occurring on a single hummock excluded)

|                                   |    |                                |     |
|-----------------------------------|----|--------------------------------|-----|
| <i>Anacardium curatellifolium</i> | 3  | <i>Lycopodium cernuum</i>      | 11* |
| <i>Annona monticola</i>           | 6  | <i>Maprounea guianensis</i>    | 4   |
| <i>Cissampelos ovalifolia</i>     | 6  | <i>Miconia albicans</i>        | 9   |
| <i>Desmocelis villosa</i>         | 6* | <i>M. fallax</i>               | 8   |
| <i>Diplusodon</i> sp.             | 4  | <i>Microlicia</i> sp.          | 7*  |
| <i>Erythroxylum campestre</i>     | 14 | <i>Palicourea xanthophylla</i> | 4   |
| <i>Jacaranda caroba</i>           | 13 | <i>Protium ovatum</i>          | 6   |
| <i>Kielmeyera neriifolia</i>      | 2  | <i>Sabicea brasiliensis</i>    | 6   |
| <i>Lippia rotundifolia</i>        | 4  | <i>Trembleya phlogiformis</i>  | 13* |

\* Found on the damp margins of the hummocks



Many observations were made of cerrado and campo sujo marginal to wet campo. Pisonia tomentosa, Plenckia populnea and Symplocos rhamnifolia were noted as particularly characteristic tree species of such areas, whilst amongst the low shrubs Jacaranda caroba and Pterandra pyroidea were abundant.

Cerrado vegetation occurs as a narrow band in places where better drained ground runs along the margins of gallery forest. The following tree species were noted as characteristic in such habitats: Bombax longiflorum\*, B. martianum\*, Dalbergia violacea, Diopyros hispida, Kielmeyera coriacea, Matayba guianensis\*, Qualea multiflora, Q. parviflora, Plenckia populnea, Symplocos rhamnifolia and Myrcia cf. tomentosa\* (the species marked with asterisks are very uncommon in other habitats on the Fazenda, apart from Luhea paniculata cerrado). Maprounea guianensis, Lippia rotundifolia and Jacaranda caroba are common amongst the lower shrubby vegetation.

#### Luhea paniculata cerrado

An area of cerrado floristically rather different from any seen in other parts of the Fazenda occurs close to the abandoned roça on the Córrego da Onça (see map 1, no. 5). It is a rather open cerrado with strongly developed ground vegetation and lies on well-drained soil. Approximate frequencies of the species of trees present are given in Table 1.

The chief interest lies in some of the tree species. Specimens of Luhea paniculata, Platypodium grandiflorum, Bombax longiflorum and Terminalia argentea reaching heights of 11 m are common, whilst trees of Bombax martianum occur. These species are normally associated with richer soils (see Ratter et al. 1977. Observações adicionais sobre o cerrado de solos mesotróficos no Brasil Central. IV Simpósio sobre o cerrado. 303-316. São Paulo.) and Luhea paniculata and Platypodium grandiflorum have not been observed in other localities on the fazenda; the other species occur in cerrado fringing gallery forests (see previous section) but only Bombax longiflorum is frequent in such habitats. Cochlospermum insignis occurs amongst the lower vegetation and was not observed anywhere else on the fazenda.

The empty shells of large land snails (Bulimus sp.) are scattered over the soil surface in considerable numbers and this is often an indicator of fair levels of soil calcium. Soil studies, however, have not yet been made in this area - they should provide an interesting future project.

### Low-growing cerrado species and ruderal habitats

Many herbaceous and low shrubby cerrado species are abundant in the disturbed habitats which occur in many parts of the fazenda, e.g. the area around the new field laboratory, aceiros, road margins, etc. Some dwarf or prostrate species seem to thrive particularly where the competition of taller ground vegetation has been removed, e.g. Stryphnodendron platyspicum, Allagoptera (Diplothemium) leucocalyx, Annona pygmaea, and Simaba suffruticosa. A few tree and shrub species also seem to have opportunist tendencies in disturbed habitats: Aegiphila lhotskyana, Solanum crinitum, and Vernonia ferruginea belong to this category - they have not been observed in undisturbed cerrado on the Fazenda although the first has been found on murundum hummocks.

### CAMPO

Campos occur in a number of forms on Fazenda Agua Limpa: wet campos are present in areas where soils are waterlogged for at least a part of the year; dry hill 'grasslands' cover the slopes to the west; and much of the rest of the Fazenda is covered with campo limpo or sparse campo sujo composed of herbaceous and low shrubby species characteristic of cerrado. The various forms are considered below.

#### Wet campo

Wet campos occur typically as a band of varying width outside the cabeceiras and gallery forests and in some other localities on low-lying ground. The vegetation varies in height, form and species composition according to local conditions - ranging from a short tussocky turf to a waist-high mass of sedges and grasses. Detailed studies have not been carried out but the species of herbs and low shrubs listed in Table 6 have been noted from such habitats.

#### Dry hill campo

Rapid observations of dry hill campo were made on the hills in the west of the Fazenda. Many of the species are those which are found in the ground cover of cerrado vegetation. The following were noted as abundant species, in many cases dominant over considerable areas: Bulbostylis emmerichiae, Rhynchospora warmingii, Rhynchospora terminalis - (all Cyperaceae), Byrsonima viminifolia, and the grass Sporobolus cubensis which was seen flowering abundantly on queimadas.

Table 6  
Species of wet campos

Asclepiadaceae

- Ditassa virgata* Fourn.  
*Oxypetalum erectum* Mart. & Zucc.

Bignoniaceae

- Jacaranda caroba* DC.

Burmanniaceae

- Apteria aphylla* (Nutt.) Bom.  
*Burmannia alba* Mart.  
*B. flava* Mart.

Compositae

- Porophyllum lineare* DC.

Cyperaceae

- Ascolepis brasiliensis* Nees  
*Rhynchospora albiceps* Kunth  
*R. consanguinea* Boeck.  
    var. *rigida* (Kunth) Kukenthal  
*R. junciformis* (Kunth) Boeck.  
*R. robusta* Boeck.  
*Scleria arundinacea* Kunth

Droseraceae

- Drosera hirtella* St. Hil.

Ericaceae

- Gaylussacia goyazensis* Benth.  
*Leucothoe chlorantha* (Cham.) DC.  
    var. *chlorantha*

Eriocaulaceae

- Syngonanthus densiflorus* (Koern.) Ruhl.  
*S. nitens* (Bong.) Ruhl.

Equisetaceae

- Equisetum giganteum* L.

Gentianaceae

- Chelonanthus viridiflorus* (Mart.) Gilg.  
*Curtia patula* (Mart.) Knobl.  
*C. tenuifolia* (Aubl.) Knobl.  
*C. verticillaris* (Spreng.) Knobl.  
*Dejanira nervosa* C. & S.  
*Lisianthus coerulescens* Aubl.

Gentianaceae (cont.)

- Schultesia* cf. *gracilis* Mart.  
*S. viridiflorus* (Mart.) Gilg.

Gesneriaceae

- Reichsteineria spicata* (Vell.) Hoehne

Gramineae

- Andropogon virgatus* Desv.  
*Axonopus* sp.  
*Schizachyrium sanguineum* (Retz) Alst.

Iridaceae

- Sisyrinchium* cf. *incurvatum* Gardn.

Labiatae

- Hyptis crenata* [Pohl ex] Benth.  
*H. linarioides* [Pohl ex] Benth.

Leguminosae

- Eriosema defoliatum* Benth.

Lentibulariaceae

- Utricularia adpressa* St. Hil.  
*U. sp.* R 2932

Lycopodiaceae

- Lycopodium alopecuroides* L.  
*L. carolinianum* L.  
*L. cernuum* L.

Lythraceae

- Cuphea* cf. *spermacoce* St. Hil.  
*C. spp.*

Melastomataceae

- Comolia lanceaeflora* (DC.) Triana  
*Desmocelis villosa* (Aubl.) Naud.  
*Lavoisiera grandiflora* Naud.  
*Microlicia* sp. R2955  
*Rhynchanthera rostrata* DC.  
*Siphanthera cordata* DC.  
*Tibouchina gracilis* (Bonpl.) Cogn.  
*Trembleya phlogiformis* DC.  
    var. *quinquernervia* Cogn.

Table 6 (cont.)

Ochnaceae

*Sauvagesia racemosa* St. Hil.

*S. sp.* R2936

Orchidaceae

*Habenaria cf. nuda* Lindl.

Polygalaceae

*Monnina exaltata* Benth.

*M. sp.* R2877

*Polygala juncea* St. Hil.

*P. linoides* Poir.

*P. longicaulis* H.B.K.

*P. subtilis* H.B.K.

Rubiaceae

*Declieuxia oenanthoides* M. Arg.

Scrophulariaceae

*Buchnera juncea* Cham. & Schlecht.

Sterculiaceae

*Melochia pyramidata* L.

Umbelliferae

*Eryngium ebracteatum* Lam.

*E. hemisphericum* Urban

Xyridaceae

*Xyris sp.* R2778

*X. sp.* R2952

*X. sp.* R3092

Previously the species Bulbostylis emmerichiae was known only from a single collection but it covers large areas on the hills of Fazenda Agua Limpa. Other elements which are characteristic of campo rupestre occur, such as a Lychnophora sp. and the Velloziaceae, Vellozia crassicaulis and Pleurostima andersonii.

Other campos

In general, as mentioned, these are composed of species found in the ground layer of cerrado and listed in Table 2. Environmental factors such as fires, soil, etc., presumably prevent the establishment of taller woody vegetation in these areas. In a large area above the Córrego da Onça Trachypogon spicatus and Tristachya leiostachya are very abundant, almost dominant, grasses of the campos.



## GALLERY FORESTS

Detailed studies were made of the gallery forests of both the Córrego da Onça and the Córrego Capitinga (see map 1, p.3). The two areas are so different that they are best considered separately (however, see Table 18, p.58 for a list of the trees found in all gallery forest areas examined).

### Córrego da Onça

The forest was studied by detailed analysis of three transects and by general observation and collecting along the length of the gallery. The transects were chosen to sample the drier cabeceira forest (T3), swampy forest (T1), and very swampy forest (T2). Following our studies, T3 was used as the gallery forest section of Ernesto's transect. Table 8 (and 9-11) give data for species occurrence, and descriptions of the vegetation are given below.

#### Marginal vegetation

In most places the forest margin forms an abrupt wall (paredão), and this is particularly the case where very wet campo extends right to the edge of the trees. Where a band of drier soil lies along the edge of the gallery, trees of typical cerrado species occur and the margin is less abrupt. A very characteristic marginal community often occurs just outside the paredão containing small shrubs and herbs such as Lavoisiera grandiflora, Macairea macedoi, Siparuna cuyabana, Sapium obovatum, Jacaranda caroba, Maprounea guianensis\*, Piper sp., Scleria arundinacea and Lippia rotundifolia, and the pteridophytes Blechnum sp., Dicranopteris flexuosa, Thelypteris sp., Lycopodium cernuum, and in places Pteridium aquilinum.

The paredão itself varies greatly, in some places consisting of massed small, slender trees only three or four metres in height, and in others of much taller, older trees overarchng the adjoining campo. Table 7 lists the characteristic tree and large shrub species.

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\*Previously such small shrubs were called M. brasiliensis St. Hil. but Allen (Acta Amazonica 6 (4): 417-422, 1976) has shown that M. brasiliensis and the tree form M. guianensis Aubl. are conspecific; the latter name has priority.

Table 7

Characteristic tree and large shrub species of the gallery margin

(Many of these species are also found deeper in the gallery.)

t, tall species; s, small species; w, damper places; d, drier places.

|                           |    |                                         |    |
|---------------------------|----|-----------------------------------------|----|
| Bauhinia rufa             | d  | Protium sp.                             | t  |
| Belangera glabra          | t  | Pseudolmedia laevigata                  | t  |
| Byrsonima umbellata       |    | Qualea dichotoma                        | td |
| Cardiopetalum calophyllum | d  | Richeria obovata                        | t  |
| Cecropia sp.              |    | Sclerolobium paniculatum                | td |
| Clusia cruiva             |    | Styrax camporum                         |    |
| Copaifera langsdorfii     | td | Symplocos nitens                        |    |
| Cyathea sp. sens. lat.    |    | Tapirira guianensis                     | t  |
| Didymopanax sp. a         |    | Tibouchina candolleana                  |    |
| Emmotum nitens            | as | Virola sebifera                         | d  |
| Erythroxylum sp.          | s  | Vochysia tucanorum                      |    |
| Euplassa inaequalis       |    | Xylopia sp.                             |    |
| Ferdinandusa speciosa     | w  | <u>Marginal cerrado species</u> (all d) |    |
| Gaylussacia brasiliensis  | sw | Bombax longiflorum                      |    |
| Guettarda viburnoides     | sd | B. martianum                            |    |
| Hedyosmum brasiliense     | sw | Dalbergia violacea                      |    |
| Ilex theezans             |    | Kielmeyera coriacea                     |    |
| Laplacea fruticosa        | t  | Plenckia populnea                       |    |
| Miconia chamissois        | s  |                                         |    |

Various smaller shrubs are also found in the paredão such as Siparuna cuyabana (already mentioned as characteristic of the marginal community and notable for the extremely aromatic smell of its foliage when crushed), Cestrum calycinum, Piper spp., etc. Herbaceous climbers are abundant, especially in places where there are many dead branches to act as support; the following are common: Mikania spp., Cayaponia tayaya, Cissampelos pareira, Cissus cf. erosa, Dioscorea marginata (?), Passiflora villosa and Serjania erecta. Two species of scrambling shrubs, Rubus urticaefolius and Sebastiania scandens, are also common in places.

Table 8

Occurrence of species in the three study areas on the Córrego da Onça.

1, swampy gallery forest; 2, very swampy gallery forest;  
3, cabeceira forest.

Common species are marked with an asterisk; a dagger indicates that the plant may also be considered as a small shrub; m = forest margin species (see p.31 and Table 7).

Some species have been listed which were not recorded on the transect plots themselves but are common in the adjacent gallery.

Trees & Shrubs

Anacardiaceae

Tapirira guianensis 1\*, 2\*, 3\*

Annonaceae

Cardiopetalum calophyllum 3

Guatteria sp. 1,3

Xylopia aromatica 3

X. emarginata 1\*, 2\*, 3

Aquifoliaceae

Ilex theezans 1, 2, 3

Araliaceae

Didymopanax sp. 1, 2, 3\*

Gilibertia cuneata 2

Bignoniaceae

Tabebuia sp. 'Ipê amarelo' 1, 2

T. sp. 'Pau de arco' 2, 3

Bombacaceae

Bombax longiflorum 3 (m)

Burseraceae

Protium spp. 1\*, 2\*, 3\*

Chloranthaceae

Hedyosmum brasiliense 1\*, 2\*

Chrysobalanaceae

Hirtella glandulosa 3\*

Cunoniaceae

Belangeria glabra 1, 2\*, 3\*

Cyatheaceae

Cyathea sp. 1\*, 2, 3\*

Ericaceae

Gaylussacia brasiliensis (m)

Erythroxylaceae

Erthroxylum amplifolium 2

E. sp. R3744 3

Euphorbiaceae

Alchornea iricurana 1, 2, 3

Maprounea guianensis 1, 3\*

Richeria obovata 1\*, 2, 3\*

Guttiferae

Calophyllum brasiliense 1\*, 2\*, 3

Clusia sp. R3717 2\*

Rheedia sp. 2

Icacinaceae

Emmotum nitens 3\*

Lauraceae

Licaria sp. 1, 3\*

'Itaúba' 1, 2

'Louro branco' 2

'Louro precioso' 2

Leguminosae, Caesalpinoideae

Bauhinia rufa 3 (m)

Copaifera langsdorfii 1, 2, 3\*

Sclerolobium paniculatum 3\*

Leguminosae, Mimosoideae

Inga sp. 3

Table 8. Trees & Shrubs (cont.)

Leguminosae, Papilionatae

- Andira sp. R3791 3  
Machaerium acutifolium 3  
Ormosia sp. R3782 3

Magnoliaceae

- Talauma ovata 2\*, 3

Malpighiaceae

- Byrsonima umbellata 1, 3\*

Meliaceae

- Cedrela odorata  
Guarea tuberculata 1, 2, 3,

Melastomataceae

- Lavoisiera grandiflora / (m)  
Macairea macedoi / (m)  
Miconia chamissois 1, 2\*, 3  
M. cf. chartacea  
var. miqueliana 1  
M. nervosa 1, 2\*, 3\*  
Tibouchina candolleana 3 (m)  
Trembleya parviflora / (m)

Monimiaceae

- Mollinedia sp. R3585 1, 2  
Siparuna guianensis  
S. cuyabana / 2 (m)

Moraceae

- Cecropia sp. 1\*, 2, 3  
Ficus sp. 2  
Pseudolmedia laevigata 1\*, 3\*  
Sorocea sp. 1, 2\*

Myristicaceae

- Virola sebifera 3\*  
V. urbaniana 2, 3

Myrsinaceae

- Cybianthus glaber 1, 2\*, 3

Myrtaceae

- Myrcia cf. deflexa 2, 3  
M. cf. gardneriana (m) 1  
M. cf. subrugosa 1, 2

Myrtaceae (cont.)

- Myrcia cf. tomentosa (m)  
'Gobiabinha' 1, 2  
'Murta' 1

Ochnaceae

- Ouratea sp. 3

Onagraceae

- Jussiaea brachyphylla 2

Palmae

- Geonoma schottiana 1, 2\*  
Euterpe sp.? 2  
Mauritia flexuosa 1

Piperaceae

- Piper arboreum 1\*

Proteaceae

- Euplassa inaequalis 1, 2, 3\*

Rhamnaceae

- Rhamnus polymorpha

Rubiaceae

- Ferdinandusa speciosa 1, 3 (m)  
Guettarda viburnoides  
Malanea macrophylla 1, 2, 3  
Palicourea sp. R3589 1\*, 2\*, 3\*

Sapotaceae

- Pouteria sp. 3

Simarubaceae

- Simaruba sp. 3

Solanaceae

- Cestrum calycinum / 2 (m)

Styracaceae

- Styrax camporum 1, 2 (m)

Symplocaceae

- Symplocos nitens 3

Theaceae

- Laplacea fruticosa



Table 8, Trees & Shrubs (cont.)

Vochysiaceae

Qualea dichotoma 3  
Vochysia pyramidalis 1, 3  
V. tucanorum 1 (m)

Family indet.

'Embireira' 1  
'Quina' 1  
R3634 2  
R3684 2

Lianas, herbaceous climbers & parasites

Asclepiadaceae

Marsdenia sp. R3745 3  
R3787 1, 3

Compositae

Mikania acuminata 1, 3 (m)  
M. sp. 1, 3 (m)

Cucurbitaceae

Cayaponia tayaya  
var. pallida (m)  
Gurania spinulosa 3

Dioscorea

Dioscorea marginata ? 3

Euphorbiaceae

Sebastiania scandens (m)

Leguminosae, Papilionatae

Phaseolus appendiculatus 1, 2

Liliaceae

Smilax syringoides 1\*, 2\*, 3\*

Memispermaceae

Cissampelos pareira (m)

Loranthaceae

Phoradendron crassifolium 2, 3

Orchidaceae

Vanilla sp. ? R 3778 1, 3

Passifloraceae

Passiflora villosa (m)  
P. sp. 1

Polygonaceae

Coccoloba sp. 1\*, 2, 3\*

Rosaceae

Rubus urticaefolius 1 (m)

Rubiaceae

Relbunium buxifolium 2, 3

Sapindaceae

Serjania spp. 1\*, 2, 3

Solanaceae

Solanum sp. 3

Vitaceae

Cissus cf. erosa (m)

Family indet.

Cipó rabo de rato 2

Herbs & small shrubs

Bignoniaceae

Jacaranda caroba 3 (m)

Commelinaceae

Commelina sp. 3

Compositae

Eupatorium vautherianum 3

Cyperaceae

Scleria arundinacea 1, 2, 3

Table 8, Herbs & small shrubs (cont.)

Gentianaceae

Leiphaimos sp. 2

Gramineae

Ichnanthus bambusiflorus 1\*, 2\*, 3\*

I. inconstans

I. nemorosus 3

Panicum sp. 'Capim Bengo' 3\*

Melastomataceae

Lavoisiera cf. bergii 1 (m)

Piperaceae

Piper spp. 1, 3

Rubiaceae

Coccocypselum lanceolatum 1\*, 2, 3

Palicourea marcgravii 3

Psychotria sp. 3

Verbenaceae

Lippia rotundifolia 1, 3 (m)

Zingiberaceae

Renealmia exaltata 1\*

Ferns (apart from Cyathea)

Blechnum sp. 1, 3 (m)

Campyloneuron phyllitidis 2

Christella sp. 2

Dicranopteris flexuosa 1 (m)

Lindsaea lancea (L.) Bedd. 1\*, 3

Polypodium fraxinifolium 2\*, 3

Pteridium aquilinum  
var. arachnoideum 1 (m)

Thelypteris sp. s.l. 2\*

Trichomanes crispum 1, 2, 3

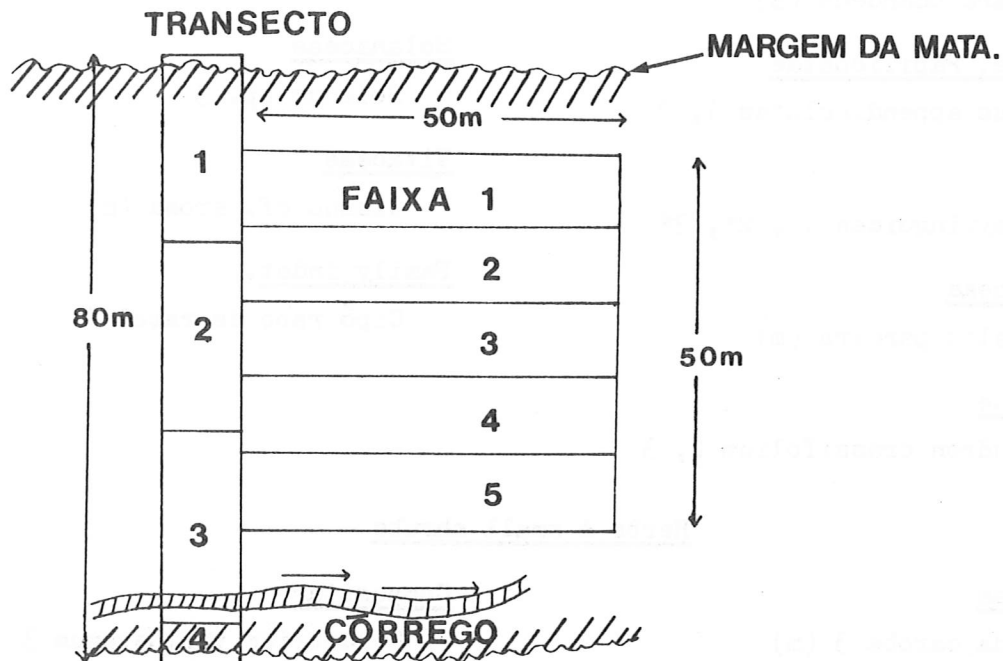


Fig.1. Transect 3. and square

The following notes refer to the sample areas individually.

Cabeceira (Transect 3 and adjoining square)

The gallery forest a short distance below the cabeceira was studied by means of a traversing 80 m belt transect and a 50 x 50 m square lying adjacent to it in the centre of the forest (see Fig. 1, p.36); in addition more cursory observations were made in the cabeceira itself.

The transect has a gradual slope and drops 5 to 6 m from the beginning of plot 1 to the stream. The soils on the slope are well-drained and even at the lowermost point boggy conditions do not occur since the stream runs in a well-defined bed - in mid-October 1976 the top of the stream banks were approximately one metre above the surface of the water. Species characteristic of boggy conditions are therefore nearly absent from the transect and correlated with this there are almost no buttress or stilt roots.

Overall occurrence of trees and lower vegetation is given in Table 8, and Table 9 records the number of trees in two trunk diameter classes plot by plot. In general the taller trees are 15-20 m and produce a fairly closed canopy giving considerable shade. In the damper area downslope the trees are massed and have slender, pole-like trunks and smooth bark. The most common tree species is Pseudolmedia laevigata which is extremely abundant in the damper places close to the stream and reaches 18 m in height and 22 cm d.b.h.; although its roots can be seen entering the water of the stream it generally appears to be a species associated with damp but not boggy conditions. Other common trees of the lower, damper part of the area are Protium spp., various Lauraceae, and in the lower layers tree ferns of the genus Cyathea s.l. In the drier parts the trees are less crowded and often have thick trunks (to 60 cm d.b.h. in Copaifera langsdorfii) and wide crowns; the following species are important: Emmotum nitens, Copaifera langsdorfii, Virola sebifera, Qualea dichotoma, and Maprounea guianensis\*. At the edge of the forest many of the characteristic species listed in Table 7 occur - e.g. in the damper places close to the stream, Richeria obovata, Euplassa inaequalis, and Ferdinandusa speciosa; and in drier places, Vochysia tucanorum, Tapirira guianensis, Bombax longiflorum, and Machaerium acutifolium.

Some smaller species of trees, seldom reaching the qualifying diameter for scoring and thus scarcely appearing in Table 9, such as Myrcia cf. deflexa ('Araçá da mata') form an understorey about 10 m tall in drier places, but little can be

\*These observations refer to the cabeceira area in general in addition to the transect itself.

Table 9

Number of trees of 8 cm d.b.h. and above on the cabeceira area transect (T3) and adjacent 50 x 50 m plot. The number of individuals of 15 cm d.b.h. and over are shown in parentheses.

|                                  | Transect plots |      |      |   | 50 x 50 m plot,<br>10 m strips |      |      |      |      | Total |
|----------------------------------|----------------|------|------|---|--------------------------------|------|------|------|------|-------|
|                                  | 1              | 2    | 3    | 4 | 1                              | 2    | 3    | 4    | 5    |       |
| <i>Andira</i> sp. R3791          | 1              | 1    |      |   |                                |      |      |      |      | 2     |
| <i>Bauhinia rufa</i>             | 2(1)           |      |      |   |                                |      |      |      |      | 2(1)  |
| <i>Belangeria glabra</i>         |                |      | 1(1) |   |                                |      | 2(2) | 1(1) | 1(1) | 5(5)  |
| <i>Bombax longiflorum</i>        | 1              |      |      |   |                                |      |      |      |      | 1     |
| <i>Calophyllum brasiliense</i>   |                |      | 1    |   | 2                              | 2(2) |      | 1    |      | 6(2)  |
| <i>Cecropia</i> sp.              |                |      |      |   | 1(1)                           | 1    |      | 1(1) |      | 3(2)  |
| <i>Copaifera langsdorfii</i>     | 2(1)           | 2(2) |      |   | 1                              | 3(3) |      |      |      | 8(6)  |
| <i>Cyathea</i> sp.               |                |      | 1    |   | 2                              | 2    | 3    | 7    | 5    | 20    |
| <i>Didymopanax</i> sp.           |                |      |      |   |                                |      |      |      | 1    | 1     |
| <i>Emmotum nitens</i>            | 4(2)           | 3(2) |      |   | 2(1)                           | 1(1) | 1(1) |      | 1(1) | 12(8) |
| <i>Erythroxylum</i> sp.          | 2              |      |      |   |                                |      |      |      |      | 2     |
| <i>Euplassa inaequalis</i>       |                |      |      | 1 | 2(1)                           | 1(1) | 1(1) |      | 2(2) | 7(5)  |
| <i>Ferdinandusa speciosa</i>     |                |      |      | 1 |                                |      |      |      | 2    | 3     |
| <i>Guarea tuberculata</i>        |                |      |      |   |                                | 1    |      |      | 2    | 3     |
| <i>Guatteria</i> sp.             |                |      |      |   |                                | 2    |      |      |      | 2     |
| <i>Hirtella glandulosa</i>       |                | 2(1) | 1(1) |   | 1                              |      | 1(1) |      |      | 5(3)  |
| <i>Machaerium acutifolium</i>    | 1(1)           |      |      |   |                                |      |      |      |      | 1(1)  |
| <i>Maprounea guianensis</i>      | 1(1)           |      |      |   | 2(2)                           |      |      |      |      | 3(3)  |
| <i>Miconia</i> sp.               |                |      | 1    |   |                                |      |      |      |      | 1     |
| <i>Myrcia</i> cf. <i>deflexa</i> | 1              |      |      |   |                                |      |      |      |      | 1     |
| <i>M.</i> cf. <i>gardneriana</i> | 1              |      |      |   |                                |      |      |      |      | 1     |
| <i>Ormosia</i> sp.               |                |      |      |   |                                |      | 1(1) |      |      | 1(1)  |
| <i>Ouratea</i> sp.               | 2              |      |      |   |                                |      |      |      |      | 2     |
| <i>Pouteria</i> sp.              |                | 2(1) |      |   |                                | 1(1) |      |      |      | 3(2)  |



Table 9 (cont.)

|                                                 | Transect plots |      |       |      | 50 x 50 m plot,<br>10 m strips |       |       |        |        |         |
|-------------------------------------------------|----------------|------|-------|------|--------------------------------|-------|-------|--------|--------|---------|
|                                                 | 1              | 2    | 3     | 4    | 1                              | 2     | 3     | 4      | 5      | Total   |
| <i>Protium</i> spp.                             |                | 2    | 8(2)  |      | 7(4)                           | 10(3) | 10(7) | 14(10) | 14(6)  | 64(32)  |
| <i>Pseudolmedia</i><br><i>laevigata</i>         | 1              | 4    | 20(5) | 2    | 14(5)                          | 16(5) | 17(6) | 23(7)  | 33(16) | 130(44) |
| <i>Qualea dichotoma</i>                         | 2(1)           | 1(1) |       |      |                                |       |       |        |        | 3(2)    |
| <i>Richeria obovata</i>                         |                |      | 1(1)  |      | 4(2)                           | 2(2)  |       |        | 3(2)   | 10(7)   |
| <i>Simaruba</i> sp.?                            |                |      |       |      |                                |       |       |        | 1      | 1       |
| <i>Sclerolobium</i><br><i>paniculatum</i>       | 2(2)           |      |       | 1(1) |                                |       |       |        |        | 3(3)    |
| <i>Symplocos</i><br><i>nitens</i>               | 1              |      |       |      |                                |       |       |        |        | 1       |
| <i>Talauma ovata</i>                            |                |      |       |      |                                | 1     |       |        |        | 1       |
| <i>Tapirira</i><br><i>guianensis</i>            | 1(1)           |      |       |      | 1                              |       | 1(1)  |        | 4(2)   | 7(4)    |
| <i>Virola sebifera</i>                          | 2(1)           | 3(2) |       |      | 2(1)                           | 4(2)  | 3(1)  |        |        | 14(7)   |
| <i>Virola urbaniana</i>                         |                |      |       |      |                                |       | 1(1)  |        |        | 1(1)    |
| <i>Vochysia</i><br><i>pyramidalis</i>           |                |      |       |      |                                | 1     | 2(2)  | 1      |        | 4(2)    |
| <i>Xylopia</i><br><i>emarginata</i>             |                | 1    |       |      |                                |       |       | 1      |        | 2       |
| Lauraceae spp.<br>(incl.<br><i>Licaria</i> sp.) | 4              | 2(1) | 3     |      | 5(4)                           | 7(3)  | 8(3)  | 19(6)  | 13(6)  | 61(23)  |

said about forest structure since this aspect was not studied in detail. Woody lianas are in general not common apart from a species of Coccoloba, but there are a number of species of herbaceous climbers such as the large Smilax syringoides and various others listed in Table 7. Epiphytes are not common but include bromeliads, e.g. Aechmea bromeliifolia (Rudge) Baker and Tillandsia sp., and various orchids.

The forest floor has a continuous cover of dead leaves, fallen branches, trunks, etc., and fair numbers of young saplings are present. In the damper parts a dense stand of Ichnanthus bambusiflorus growing to nearly 2 m tall occurs, and another grass, Panicum sp. 'Capim Bengo', forming large clumps to 1 m tall, is quite common in somewhat drier parts.

Forest floor species are rather sparse in the best-drained areas, apart from the small grass Ichnanthus nemorosus and, in the marginal zone, Eupatorium vautheranum. Two herbaceous Rubiaceae, Palicourea marcgravii and Coccocypselum lanceolatum, are also worthy of mention: the former is made conspicuous by its multi-coloured inflorescences and flowers of yellow, pink and purple, and the latter by its very blue fruits.

The forest shows evidence of human disturbance in the past although not to a great degree. A considerable time ago ( $\pm$  10 years?) a large number of saplings were felled with a billhook and the stumps, marks of cutting, etc., can still be seen; however, the area was not cultivated. Charring of stumps and fallen timber, also shows that there has been at least one fire in the forest.

At each end of the transect the forest is bounded by campo with a typical marginal community as described on p.31.

#### Swampy gallery forest (Transect 1)

At Transect 1 the forest is about 85 m across and on nearly level ground. The 2 m wide stream runs approximately in the middle of the forest (34 m from its northern margin) and at the beginning of October 1976 nearly filled its deep bed - the tops of the banks being approximately 15 cm above the surface of the water. The soil is damp and becomes very boggy later in the rainy season. Fig. 2, p.42, shows the arrangement of plots in the transect.

Table 8 gives overall occurrence of trees and lower vegetation and Table 10 records the numbers of trees in two diameter classes and also the occurrence of smaller trees. The taller trees are 14-20 m tall and form a fairly dense canopy in the centre of the gallery near the stream; in the marginal area at the beginning

Table 10

Number of trees of 5 cm d.b.h. and above on the swampy gallery forest transect (T1). Number of individuals of 15 cm d.b.h. and above shown in parentheses. Column P records presence of trees below qualifying size: the figure refers to the number of plots on which they are present and is sometimes accompanied by a frequency symbol (a, abundant; c, common; f, frequent; o, occasional; r, rare) - in some of the smaller species few individuals reach qualifying size.

|                                                   | PLOT |      |      |      | TOTAL | P  |
|---------------------------------------------------|------|------|------|------|-------|----|
|                                                   | 1    | 2    | 3    | 4    |       |    |
| <i>Alchornea iricurana</i>                        |      |      |      |      |       | 1  |
| <i>Belangeria glabra</i>                          |      | 1    |      | 1(1) | 2(1)  | 1  |
| <i>Byrsonima umbellata</i>                        |      |      |      | 1    | 1     | 1  |
| <i>Calophyllum brasiliense</i>                    | 2(1) | 6(3) |      |      | 8(4)  | 2c |
| <i>Cecropia</i> sp.                               | 2    | 3    | 8    | 2    | 15    | 2a |
| <i>Copaifera langsdorfii</i>                      |      |      |      |      |       | 3  |
| <i>Cyathea</i> sp.                                | 1    | 10   | 3    | 1    | 15    | 1  |
| <i>Cybianthus glaber</i>                          |      | 1    |      |      | 1     | 1  |
| <i>Dudmopanax</i> sp.                             | 3    | 1    |      |      | 4     | 4o |
| <i>Euplassa inaequalis</i>                        | 1(1) | 1    |      |      | 2(1)  | 1  |
| <i>Ferdinandusa speciosa</i>                      | 1    |      |      | 3(1) | 4(1)  | 1r |
| <i>Geonoma schottiana</i>                         |      |      |      |      |       | 1  |
| <i>Guarea tuberculata</i>                         |      | 3    | 2    |      | 5     | 3o |
| <i>Guatteria</i> sp.                              | 1    |      |      |      | 1     | -  |
| <i>Hedyosmum brasiliense</i>                      | 1    |      | 9    |      | 10    | 4c |
| <i>Ilex theezans</i>                              |      |      |      |      |       | 2r |
| <i>Licaria</i> sp.                                |      | 2    |      |      | 2     | 2f |
| <i>Maprounea guianensis</i>                       |      |      |      |      |       | 2o |
| <i>Mauritia flexuosa</i>                          |      | 1(1) |      |      | 1(1)  | -  |
| <i>Miconia chamissois</i>                         |      |      | 1    |      | 1     | 3o |
| <i>M. cf. chartacea</i><br>var. <i>miqueliana</i> | 1    |      |      |      | 1     | 1  |
| <i>M. nervosa</i>                                 |      |      |      |      |       | 3  |
| <i>Mollinedia</i> sp.                             |      |      |      |      |       | -  |
| <i>Myrcia cf. subrugosa</i>                       |      |      |      |      |       | 1  |
| <i>M. tomentosa</i>                               |      |      |      |      |       | 1  |
| <i>Malanea macrophylla</i> )                      |      |      |      | 2    | 2     | 3a |
| <i>Palicourea</i> sp. R3589 )                     |      |      |      |      |       |    |
| <i>Piper arboreum</i>                             |      |      | 1    |      | 1     | 3c |
| <i>Protium</i> spp.                               | 3(2) | 5    | 2(2) | 2(2) | 12(6) | 3c |

TABLE 10 (cont.)

|                                  | PLOT |      |      |      | TOTAL | P  |
|----------------------------------|------|------|------|------|-------|----|
|                                  | 1    | 2    | 3    | 4    |       |    |
| <i>Pseudolmedia laevigata</i>    | 1    | 4(2) | 4(4) | 8(2) | 17(8) | 3c |
| <i>Richeria obovata</i>          | 5(3) |      |      | 5(3) | 10(6) | 3f |
| <i>Sorocea</i> sp.               |      |      |      |      |       | 1  |
| <i>Styrax camporum</i>           |      |      |      | 3(1) | 3(1)  | -  |
| <i>Tapirira guianensis</i>       | 4(3) | 1    | 1    |      | 6(3)  | -  |
| <i>Vochysia pyramidalis</i>      |      |      |      | 1(1) | 1(1)  | -  |
| <i>V. tucanorum</i>              |      |      |      |      |       | 1c |
| <i>Xylopia emarginata</i>        | 1    | 1    |      |      | 2     | 4c |
| Lauraceae sp. 'Itaúba'           |      | 2(2) |      |      | 2(2)  | -  |
| Myrtaceae sp. 'Murta'            | 1    |      |      |      | 1     | -  |
| Family indet. sp.<br>'Embireira' |      | 3    |      |      | 3     | -  |
| Family indet. sp. 'Quina'        | 2    |      |      |      | 2     | -  |

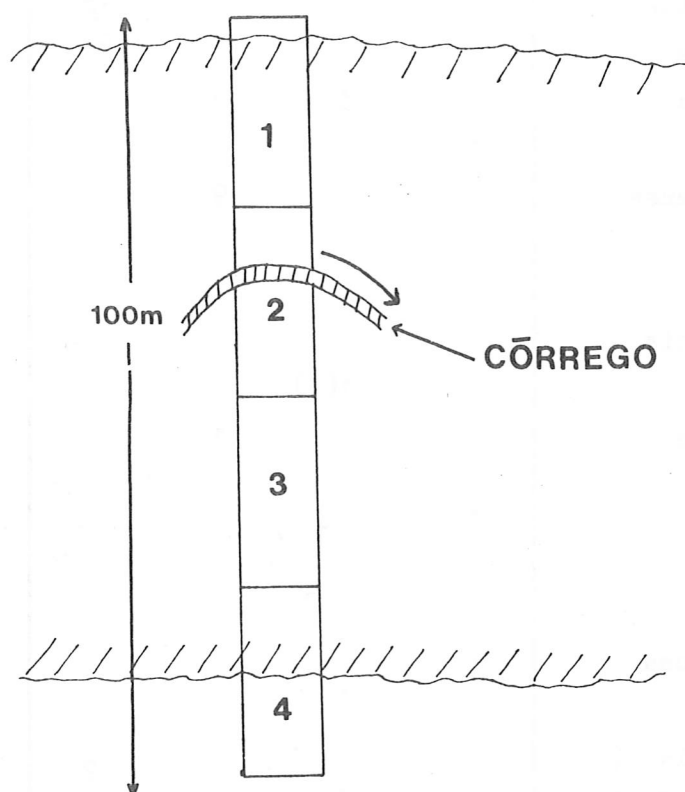


Fig.2. Transect 1.



of the transect the canopy is less complete, and on the other side of the gallery many large trees have been windblown and there is a patch of caapoeira-type vegetation. As in the damper parts of the cabeceira transect (T3) the most common larger tree species is Pseudolmedia laevigata, and Protium spp. are also common. Calophyllum brasiliense is also an important large species, as are Richeria obovata and Tapirira guianensis in the marginal zone. Emergent specimens of Mauritia flexuosa are common in the area, as they are throughout the Córrego da Onça, but only a single tree actually occurs on the transect. In places there is a well-developed understory of small tree species; particularly characteristic amongst these are Miconia nervosa, Malanea macrophylla, Palicourea sp. R3589 and, in boggy places, the stilt-rooted Hedyosmum brasiliense. The stems of these small trees are usually less than 5 cm and hence too slender to qualify for individual scoring in the tables.

The damp peaty soil is covered in a continuous layer of dead leaves, fallen branches, and trunks in varying stages of decomposition. Superficial roots spread all over the floor, which is also humped by breathing roots - see p.64 for a description of the roots of the forest trees. Small trees and saplings are very abundant just within the marginal zone of plot 1, and inside this is a zone where the tall grass Ichnanthus bambusiflorus is dominant in the ground vegetation, forming a dense stand to 2.5 m tall; this species is very important throughout the transect although it is sparser in the area of deep shade around the stream. Another large herbaceous species, Renealmia exaltata (Zingiberaceae), forms clumps of shoots to 3 m tall from rhizomes in the wet peaty soil, and in places grows in mixed stand with Ichnanthus bambusiflorus. Cyathea tree ferns are common in the area of deep shade close to the stream where ground vegetation is sparse.

Coccoloba sp. and Smilax syringoides are very common tall climbers in the area and the thorns on the stems of the latter can make walking through the forest dangerous to person and clothing.

In the area in plots 3 and 4 where large trees have been windblown a dense caapoeira-type vegetation has developed with large numbers of young trees of Cecropia and shrubs of Piper and Vernonia. The small trees and fallen timber are smothered in herbaceous climbers amongst which a Mikania and a Phaseolus are particularly conspicuous. The fern Pteridium aquilinum is also common.

### Very swampy gallery forest (Transect 2)

This transect was chosen to represent the boggiest type of gallery forest on the Fazenda. It is situated near the junction of the Córrego da Onça and the other affluent of the Córrego Taquara running from the south (map 1). The transect is 75 m long and starting from the stream itself runs obliquely through the gallery on the far side of the road (see Fig. 3, p.47); the area lying on the side of the stream closest to the road (consisting of approx. 40 m of forest) was not analysed because it had been used to provide timber for the Fazenda and was much disturbed.

In October 1976 the stream was at the top of its banks and the soil surface was extremely wet and boggy, with many pools of standing water present. The soil surface was well-covered with rotting leaves and branches and thrown up into hummocks by breathing and other superficial roots, while buttress and stilt roots so characteristic of trees of boggy conditions were extremely common in the area (see p.64 where this subject is treated in more detail).

Species recorded on the transect are listed in Tables 8 and 11. The taller trees are 14-20 m tall and in the central area of the forest form a dense canopy producing considerable shade. The most important species is Calophyllum brasiliense which constitutes 40% of the total number of trees of 5 cm d.b.h. or above on the first plot of the transect, and over half of those of 15 cm d.b.h. or more - the area could be classed as a 'Landizal'. Other important tall species are Xylopia emarginata and Açaí palms (Euterpe sp. ?), although large specimens of the former are not so common on the transect itself as they are in the surrounding area. X. emarginata is a tall, slender-trunked, narrow-crowned, often emergent tree which provides the characteristic appearance of many Federal District galleries; the abundant Calophyllum brasiliense is also of narrow-crowned growth form although to a lesser extent than X. emarginata.

Talauma ovata is an important tree in the wettest places; it is generally a tall member of the understorey from 9-12 m in height but sometimes reaches the top storey. Hedyosmum brasiliense, Malanea macrophylla and Palicourea sp. R3589 are abundant small understorey trees: they are seldom more than 4 m tall and most individuals do not reach 5 cm d.b.h. and therefore, as previously mentioned, are not recorded in the tables. Other species of this layer are Geonoma schottiana (a clumped rhizomatous palm), Erythroxylum amplifolium, a Clusia species, Cybianthus glaber, Guarea tuberculata and tree ferns of the genus Cyathea sens. lat.



Table 11

Number of trees of 5 cm d.b.h. and above on the very swampy gallery forest transect (T2). Number of individuals of 15 cm d.b.h. and above shown in parentheses. Column P records presence of trees below qualifying size: the figure refers to the number of plots on which they are present and is accompanied by a frequency symbol (a, abundant; c, common; f, frequent; o, occasional; r, rare) - in some of the smaller species, e.g. *Hedyosmum brasiliense*, few individuals reach the qualifying size.

\* = common just off the transect; m = marginal

|                                      | PLOT  |      |       | TOTAL | P    |
|--------------------------------------|-------|------|-------|-------|------|
|                                      | 1     | 2    | 3     |       |      |
| <i>Alchornea iricurana</i>           | 1     |      |       | 1     |      |
| <i>Belangera glabra</i>              | 4(2)  | 1    | 1(1)  | 6(3)  | 2f   |
| <i>Calophyllum brasiliense</i>       | 32(6) | 12   | 6     | 50(6) | 3c   |
| <i>Cecropia</i> sp.                  | 1     |      | 1     | 2     |      |
| <i>Clusia</i> sp. R3717              |       |      |       |       | 2a   |
| <i>Copaifera langsdorfii</i>         |       | 1    |       | 1     |      |
| <i>Cyathea</i> sp.                   | 1     |      |       | 1     | 1    |
| <i>Cybianthus glaber</i>             |       |      |       |       | 2c   |
| <i>Didymopanax</i> sp.               | 1     |      |       | 1     | 1    |
| <i>Erythroxylum amplifolium</i>      | 1     | 2    |       | 3     | 2o   |
| <i>Euplassa inaequalis</i>           | 1     |      | 1     | 2     |      |
| <i>Euterpe</i> sp.                   |       |      |       |       |      |
| <i>Ficus</i> sp.                     | 2(1)  | 1    |       | 3(1)  |      |
| <i>Geonoma schottiana</i>            | 4     |      |       | 4     | 2a   |
| <i>Gilibertia</i> cf. <i>cuneata</i> | 1     |      | 4     | 5     | 1f   |
| <i>Guarea tuberculata</i>            | 2     |      |       | 2     | 1o   |
| <i>Hedyosmum brasiliense</i>         | 1     | 5    |       | 6     | 4a   |
| <i>Ilex theezans</i>                 |       |      | 1     | 1     |      |
| <i>Jussiaea brachyphylla</i>         |       |      |       |       | 1    |
| <i>Laplacea fruticosa</i> *          |       |      |       |       |      |
| <i>Miconia chamissois</i>            |       |      |       |       | 2f   |
| <i>M. nervosa</i>                    |       |      |       |       | 1c   |
| <i>Mollinedia</i> sp.                | 1     |      |       | 1     | 2r   |
| <i>Myrcia</i> cf. <i>subrugosa</i>   |       | 1    |       | 1     |      |
| <i>M. tomentosa</i>                  | 2     |      |       | 2     | 1r   |
| <i>Malanea macrophylla</i> }         |       |      |       |       | 3a   |
| <i>Palicourea</i> sp. R3589 }        |       |      |       |       |      |
| <i>Protium</i> spp.                  | 2     | 8(1) | 10(4) | 20(5) | 2f   |
| <i>Rheedia</i> sp.                   |       | 2    |       | 2     |      |
| <i>Richeria obovata</i>              | 1     |      |       | 1     |      |
| <i>Sorocea</i> sp.                   | 2     |      |       | 2     | 2a   |
| <i>Styrax camporum</i>               |       |      |       |       | 3(m) |

Table 11 (cont.)

|                              | 1     | PLOT<br>2 | 3    | TOTAL | P  |
|------------------------------|-------|-----------|------|-------|----|
| Tabebuia sp. 'Ipê amarelo'   | 2     |           |      | 2     |    |
| T. sp. 'Pau de arco'         |       | 2(1)      | 1(1) | 3(2)  |    |
| Talauma ovata                | 10(1) |           |      | 10(1) | 3f |
| Tapirira guianensis          | 2     | 1         | 6(1) | 9(1)  | 2f |
| Virola urbaniana             |       | 3         |      | 3     |    |
| Xylopia emarginata           | 3(1)  | 6         | 1    | 10(1) | 3a |
| Lauraceae sp. 'Louro branco' | 2     |           |      | 2     |    |
| " 'Louro precioso'           |       | 1         | 1    | 2     |    |
| Myrtaceae sp. R3724          |       | 1         |      | 1     | 2  |
| Family indet. sp. R3634      | 1     |           |      | 1     |    |
| " R3684                      |       | 2         | 1    | 3     |    |

Ground vegetation is very sparse in the deep shade of the central part of the forest. The fern Campyloneuron phylliditis forms large clumps on the tree-root hummocks and Polypodium fraxinifolium crawls on the floor and climbs on the trees. A species of the little Gentianaceous saprophyte Leiphaimos, with purple flowers and stems, is frequent, as is the low, blue-fruited, Coccocypselum lanceolatum. Ichnanthus bambusiflorus is also found in the denser shade but is not as common as in areas where more light reaches the ground. Lianas are present but not very common; the most frequent is Smilax syringoides ('Cipo Japécanga').

Closer to the forest margin at the end of plot 1 and in plot 2 the canopy is very open but soil conditions are as boggy as in the deep shade close to the stream. Here there is a dense thicket of small slender trees and shrubs, the most common of which are Hedyosmum brasiliense (sometimes reaching 6 or 7 m), Clusia sp., Malanea macrophylla, Palicourea sp. R3589, Miconia chamissois and a shrubby Piper. In this area Ichnanthus bambusiflorus is abundant and in places produces a nearly complete stand 2 m tall with abundant Polypodium fraxinifolium covering the ground below it.

In the marginal zone tree species such as Tapirira guianensis and Protium spp. which seem to 'prefer' slightly drier conditions are important, characteristic shrubby species such as Cestrum calycinum appear, and the marginal community described on p.31 is present.



### Córrego Capitinga

The cabeceira of the Córrego Capitinga was studied by means of the detailed analysis of a 50 x 50 m square, more or less in its centre, and more general observation and collecting throughout the area. Less time was available for study than in the case of the Córrego da Onça and therefore the results are less detailed.

In the area studied the stream runs in a deep valley and the soils are in general well-drained.

#### Marginal zone

The marginal zone is similar to that found in the drier parts of the Córrego da Onça except that large trees (to c. 15 m tall) of Callisthene major are abundant (in places practically in pure stand) whereas they were not recorded on the Córrego da Onça. Other important tall trees are Belangera glabra, Sclerolobium paniculatum, Qualea dichotoma, Maprounea guianensis and Cabranea canjerana. A fringing zone of cerrado tree species occurs in many parts, and important amongst these are Qualea multiflora, Symplocos rhamnifolia and many of the other species mentioned for the Córrego da Onça. Amongst the smaller forest margin trees not noted on the Córrego da Onça are Hyptris cana, a tree reaching 6 m belonging to the predominantly herbaceous family Labiatae, and the Sapindaceous Matayba guianensis. Table 12 gives the trees noted at the forest margin in the drier areas. In the few places where wetter conditions do obtain the type of marginal community typical of so much of the Córrego da Onça is found with Ferdinandusa speciosa and Richeria obovata common amongst the trees.

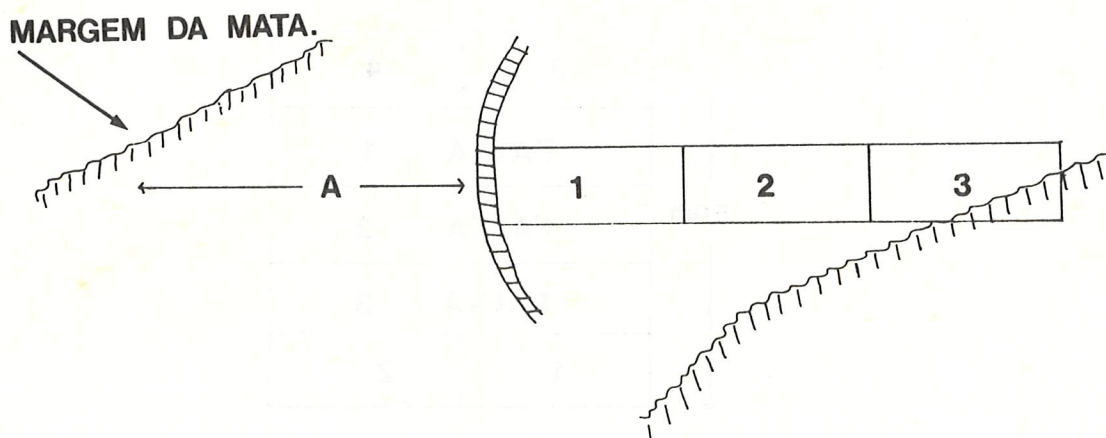


Fig.3. Transect 3. (A is the disturbed area of forest- see p.44 ).

Table 12

Tree species of the forest margin of  
the cabeceira of the Córrego Capitinga

a = abundant; c = common; f = frequent; t = tall; w = wetter places.

*Andira* sp. R3791

*Belangeria glabra* tc

*Callisthene major* ta

*Cabralea canjerana*

*Copaifera langsdorfii* tc

*Didymopanax* sp.

*Emmotum nitens*

*Euplassa inaequalis*

*Ferdinandusa speciosa* w

*Hirtella glandulosa*

*Hyptis cana*

*Jacaranda caroba*?

*Machaerium acutifolium* tc

*Maprounea guianensis* t

*Matayba guianensis*

*Piptocarpha macropoda*

*Qualea dichotoma* tf

*Sclerolobium paniculatum* c

*Tapirira guianensis*

*Tibouchina candolleana*

*Virola urbaniana*

*Vochysia pyramidalis*

*V. tucanorum*

*Xylopia aromatica*

*Lauraceae* sp.

Species of fringing cerrado

*Bombax longiflorum*

*B. martianum*

*B. tomentosum*

*Dalbergia violacea*

*Diospyros hispida*

*Enterolobium ellipticum*

*Kielmeyera coriacea*

*Lafoensia pacari*

*Myrcia* cf. *tomentosa*

*Qualea multiflora*

*Q. parviflora*

*Stryphnodendron barbatimao*

*Symplocos rhamnifolia*

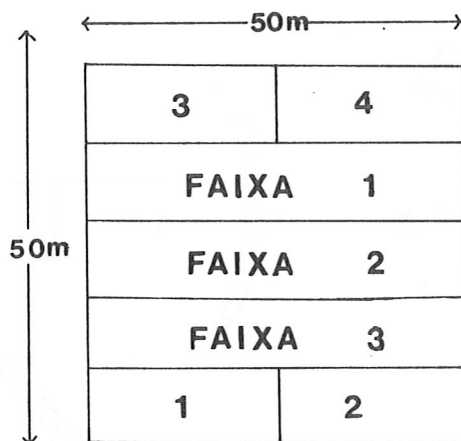


Fig.4. Córrego Capitinga square.

### Interior of forest

The 50 x 50 m square in the centre of the cabeceira was analysed by means of four 25 x 10 m plots sited as shown in fig. 4 in which all trees over 5 cm d.b.h. were noted individually and all other vegetation recorded, and three 50 x 10 m strips on which only trees over 8 cm d.b.h. were recorded. The tree records for the plots and strips are therefore not strictly comparable since the diameter qualification for inclusion is different, but nevertheless to give a rough estimate of comparative frequency they have been totalled together in Table 13.

The taller trees are from 20 to 30 m in height with wide crowns (22 m across recorded in one Copaifera langsdorfii) and thick trunks to 70 cm d.b.h. They do not form a continuous canopy but this is produced at a lower level by a dense understorey of trees 10-15 m tall which cast deep shade. The most important species of tall trees on the square are Lauraceae sp. 'Farinha seca' and Pouteria sp. R3848, but in the more extensive reconnaissance of the forest other species were noted and these will be mentioned later. The understorey is dominated by Amaioua guianensis, which constitutes no less than 45% of all trees recorded, and Salacia elliptica, with thick, leathery leaves, is another important species of this layer. Amongst smaller tree species, which were seldom large enough to qualify for recording, Cupania vernalis and a Sorocea species were common.

Ground vegetation is generally sparse due to the density of the shade and the forest is easy to walk through. There are, however, considerable numbers of seedlings and small saplings of the tree species, amongst which Piptocarpha macropoda is particularly abundant. Where there is slightly more penetration of light to the forest floor, the tall, broad-leaved grass Olyra latifolia is abundant, and in areas where the fall of trees has opened the canopy even more Panicum sp. 'Capim Bengó' forms continuous stands about 90 cm tall. The herbaceous and other forest floor species are recorded in Table 14.

A number of species of lianas are common (see Table 14) but in general they are not a striking feature of the forest. Araceous root climbers and epiphytic orchids (e.g. Brassavola perrinii Lindl., Isochilus linearis R. Br., Oncidium varicosum Lindl., Sophranitella violacea (Lindl.) Schlchtr.), bromeliads, and ferns are, however, very common.

The forest-floor is well-drained and has a continuous covering of dead leaves, fallen branches, trunks, etc. An interesting feature are the erect 'cernos' - cores of resistant heartwood of Piptadenia falcata, which stand as spiny stakes sometimes reaching 4 m in height and register the former presence of a tree of this species. Charring of the 'cernos' and dead branches on the forest floor shows that there have previously been fires deep in the forest, but there is little other evidence of much human disturbance.



Table 13

Occurrence of tree species on the Córrego Capitinga 50 x 50 m square.

Minimum qualifying d.b.h. is not uniform: on the four 25 x 10 m plots it is 5 cm and on the three 50 x 10 m strips it is 8 cm (see Fig. 4).

Presence of trees under the minimum qualifying d.b.h. were recorded on the plots but not on the strips and therefore column 1 is inaccurate since most species are underscored - this is particularly the case in small species, such as Cupania vernalis, in which most or all specimens encountered are below qualifying d.b.h.

|                                    | Presence<br>(No. of plots<br>and strips)<br>(max. = 7) | No. of trees<br>of qualifying<br>d.b.h. | No. more than<br>15 cm<br>d.b.h. |
|------------------------------------|--------------------------------------------------------|-----------------------------------------|----------------------------------|
| <i>Alibertia</i> sp.? R3844V       | 2                                                      | 2                                       | 1                                |
| <i>Amaioua guianensis</i>          | 7                                                      | 88                                      | 28                               |
| <i>Andira</i> sp.                  | 3                                                      | 3                                       | 1                                |
| <i>Apuleia molaris</i>             | 1                                                      | 1                                       | 1                                |
| <i>Aspidosperma</i> sp. 'Guatambú' | 1                                                      | -                                       | -                                |
| A. sp. 'Quina da mata'             | 1                                                      | 1                                       | 1                                |
| <i>Astronium fraxinifolium</i>     | 1                                                      | 1                                       | 1                                |
| <i>Belangeria glabra</i>           | 1                                                      | 1                                       | -                                |
| <i>Callisthene major</i>           | 2                                                      | 1                                       | -                                |
| <i>Casearia grandiflora</i> )      | 4                                                      | 2                                       | -                                |
| <i>C. sylvestris</i>               |                                                        |                                         |                                  |
| <i>Cedrela</i> sp. ?               | 1                                                      | 1                                       | 1                                |
| <i>Cheiloclinum cognatum</i>       | 1                                                      | 1                                       | -                                |
| <i>Copaifera langsdorfii</i>       | 4                                                      | 2                                       | 2                                |
| <i>Cupania vernalis</i>            | 3                                                      | -                                       | -                                |
| <i>Didymopanax</i> sp.             | 1                                                      | -                                       | -                                |
| <i>Emmotum nitens</i>              | 2                                                      | 2                                       | 1                                |
| <i>Euplassa</i> sp.                | 1                                                      | -                                       | -                                |
| <i>Guatteria sellowii</i>          | 6                                                      | 7                                       | 3                                |
| <i>Hirtella glandulosa</i>         | 3                                                      | 2                                       | -                                |
| <i>Hymenaea stilbocarpa</i>        | 1                                                      | -                                       | -                                |
| <i>Inga alba</i>                   | 5                                                      | 4                                       | 2                                |
| <i>Licania</i> sp.                 | 1                                                      | 1                                       | -                                |
| <i>Maprounea guianensis</i>        | 4                                                      | 3                                       | 1                                |
| <i>Matayba guianensis</i>          |                                                        |                                         |                                  |



Table 13 (cont.)

|                               | Presence<br>(no. of plots<br>and strips)<br>(max. = 7) | No. of trees<br>of qualifying<br>d.b.h. | No. more<br>than 15 cm<br>d.b.h. |
|-------------------------------|--------------------------------------------------------|-----------------------------------------|----------------------------------|
| Miconia sellowiana?           | 1                                                      | -                                       | -                                |
| Mouriri cf. glazioviana       | 1                                                      | 1                                       | 1                                |
| Myrcia cf. deflexa            | 2                                                      | 1                                       | -                                |
| Ouratea sp.                   | 2                                                      | 1                                       | -                                |
| Piptocarpha macropoda         | 4                                                      | -                                       | -                                |
| Piptadenia falcata (cernos)   |                                                        |                                         |                                  |
| Pisonia graciliflora?         | 5                                                      | 6                                       | 3                                |
| Pouteria sp. R3848            | 5                                                      | 7                                       | 4                                |
| Protium sp.                   | 3                                                      | 1                                       | -                                |
| Qualea multiflora?            | 3                                                      | 1                                       | 1                                |
| Q. sp.                        | 1                                                      | -                                       | -                                |
| Salacia elliptica             | 6                                                      | 11                                      | 4                                |
| Sclerolobium paniculatum      | 1                                                      | 1                                       | -                                |
| Sideroxylon venulosum         | 3                                                      | 1                                       | 1                                |
| Sorocea sp.                   | 5                                                      | 1                                       | -                                |
| Tapirira guianensis           | 4                                                      | 5                                       | 4                                |
| Virola sebifera               | 1                                                      | -                                       | -                                |
| V. sp.                        | 3                                                      | 3                                       | 3                                |
| Xylopia sericea               | 2                                                      | 1                                       | 1                                |
| Combretaceae sp. 'Miringiba'  | 4                                                      | 2                                       | 1                                |
| Lauraceae sp. 'Farinha seca'  | 7                                                      | 15                                      | 13                               |
| " 'Louro pitanga'             | 2                                                      | 2                                       | 2                                |
| Myrtaceae sp. 'Folha miuda'   | 1                                                      | 1                                       | -                                |
| " 'Goiabinha'                 | 1                                                      | 1                                       | -                                |
| Rubiaceae sp. R3847V          | 1                                                      | 2                                       | -                                |
| Family indet. sp. 'Urucurana' | 1                                                      | 1                                       | 1                                |
| " 2                           | 1                                                      | 1                                       | -                                |
| " 3                           | 1                                                      | 1                                       | -                                |
| " 4                           | 1                                                      | 1                                       | -                                |
| " 5                           | 1                                                      | 1                                       | -                                |
| " 6                           | 1                                                      | 1                                       | -                                |
| " R3851V                      | 1                                                      | 1                                       | -                                |

Table 14

Occurrence of herbs, small shrubs and lianas on  
the Córrego Capitinga 50 x 50 m square.

Figures refer to the number of plots (max. = 4)  
on which they occur.

Herbs and small shrubs

|                                             |   |                                          |   |
|---------------------------------------------|---|------------------------------------------|---|
| Cephaelis glabrescens<br>(M. Arg.) Standley | 3 | Psychotria sp. R3866                     | 2 |
| Commelina sp.                               | 2 | Rudgea sp.                               | 1 |
| Ichnanthus nemorosus                        | 3 | Ruellia sp. R3873                        | 3 |
| Jacaranda caroba                            | 1 | Scleria arundinacea                      | 1 |
| Leandra melastomoides                       | 1 | Solanum sp. R3867                        | 3 |
| Miconia hirtella                            | 1 | Piper sp. R3861                          | 1 |
| Olyra latifolia                             | 4 | P. sp. R3862                             | 3 |
| Palicourea sp. R3883V                       | 3 | Family indet. sp. 'Espinho<br>de agulha' | 1 |
| Panicum sp. 'Capim Bengó'                   | 4 |                                          |   |

Lianas and herbaceous climbers

|                      |   |                                              |   |
|----------------------|---|----------------------------------------------|---|
| Dioscorea marginata? | 1 | Bignoniaceae sp.                             | 1 |
| Paullinia sp. R3876  | 2 | Leguminosae sp. 'Rabo de<br>Camaleão' R3881V | 4 |
| Serjania sp. R3875   | 3 | Leguminosae sp. 'Rabo de<br>Camaleão' R3882V | 3 |

More extensive reconnaissance of the forest showed that the 50 x 50 m square is reasonably representative. Of the important tall species noted all but three were present on the 50 x 50 m square, although frequently represented there only by small specimens. The exceptions were Ficus sp. 'Gameleirinha', Ormosia sp. and Piptadenia falcata - the last represented on the square by dead vestiges (cernos). 'Giant' trees of the following species were noted (figures for height are only a very approximate estimate): Qualea multiflora? (35+ m tall x 90 cm d.b.h.), Apuleia molaris (two individuals 35+ m tall x 88 and 68 cm d.b.h., and others approaching these dimensions), Piptadenia falcata (75 cm d.b.h.). Amaioua guianensis is abundant as a tall understorey species and some individuals reach the canopy (one was noted  $\pm$  20 m tall and 40 cm d.b.h.); Salacia elliptica is also very common in this layer as a 10-12 m tree with a very dense crown which produces deep shade; other common smaller understorey species are Casearia grandiflora, Cupania vernalis and a Sorocea species. In places where there had been more penetration of light due to the fall of large trees, Piptocarpha macropoda and Sclerolobium paniculatum were noted; both are species with opportunist (weedy) tendencies which grow into quite tall slender trees. Palms are not common and Cecropia is rare. The occurrence of lianas and ground vegetation throughout the area was very similar to that noted on the 50 x 50 m square.

As would be expected on a well-drained soil, buttress roots are not a common feature of the forest. They are, however, quite well developed in the Combretaceous 'Miringiba', and Aspidosperma sp. 'Quina da mata' has narrow buttresses at the base which extend right up the trunk as lobes.

The presence of giant trees of Qualea multiflora in the forest possibly gives evidence of the expansion of the cabeceira during the lifetime of an individual tree. This species is very common in the marginal fringing cerrado and perhaps these trees originated in this habitat and have survived long after the death of other cerrado species following encroachment by forest. On the other hand young plantlets were seen in the forest and if these unexpectedly manage to establish under forest conditions no exotic explanation is necessary for the presence of this species. The occurrence of many 'cernos' of Piptadenia falcata shows that this species was formerly more common in the forest than it is now.

In our previous work we have found Piptadenia falcata, Astronium fraxinifolium and Aspidosperma sp. 'Guatambú' associated with mesotrophic soils, and their presence here suggests that the soils of this cabeceira may be richer than those of the other areas studied.

### Other forest localities

Time only allowed cursory observation of two other forest localities:

(a) the disturbed, relatively narrow, gallery forest of the Córrego Capitinga by the bridge close to the sede; and (b) the disturbed area close to the main northern entrance.

(a) Table 15 gives a very incomplete list of tree species at this location. The stream runs in a deep valley and the soil of the forest is well drained. Boggier conditions, however, occur in places round the margin and here species characteristic of these conditions are found, e.g. Ferdinandusa speciosa. The taller trees reach about 20 m and form a much broken canopy which allows much light penetration to the floor so that there are considerable stands of the tall grasses Ichnanthus bambusiflorus and Panicum sp. 'Capim Bengó'.

Table 15 shows that the gallery forest has, as would be expected, much in common floristically with the cabeceira lying above.

Table 15

Trees (and shrubs) of the gallery forest  
near the bridge over the Córrego Capitinga

c = common; m = marginal; o = occasional;  
s = small; t = tall; vs = very small

|                                         |    |                                 |      |
|-----------------------------------------|----|---------------------------------|------|
| <i>Aegiphila sellowiana</i>             | s  | <i>Ferdinandusa speciosa</i>    | m    |
| <i>Alchornea iricurana</i>              | s  | <i>Guatteria sellowiana</i>     |      |
| <i>Amaioua guianensis</i>               | o  | <i>Inga</i> sp.                 |      |
| <i>Aspidosperma</i> cf. <i>pruinsum</i> | t  | <i>Maprounea guianensis</i>     | tc   |
| <i>Belangeria glabra</i>                |    | <i>Miconia</i> sp.              |      |
| <i>Byrsonima umbellata</i>              | sm | <i>Piptocarpha macropoda</i>    |      |
| <i>B.</i> sp.                           | s  | <i>Pouteria</i> sp.             | s    |
| <i>Callisthene major</i>                | tc | <i>Protium</i> sp.              | t    |
| <i>Casearia sylvestris</i>              | s  | <i>Qualea dichotoma</i>         | t    |
| <i>Cecropia</i> sp.                     |    | <i>Richeria obovata</i>         | m    |
| <i>Cedrela odorata</i> ?                |    | <i>Sclerolobium paniculatum</i> | t    |
| <i>Copaifera langsdorfii</i>            | t  | <i>Siparuna cuyabana</i>        | vs m |
| <i>Cupania vernalis</i>                 | s  | <i>Styrax camporum</i>          | m    |
| <i>Cyathea</i> sp.                      | s  | <i>Tapirira guianensis</i>      |      |
| <i>Didymopanax</i> sp.                  |    | <i>V.</i> <i>pyramidalis</i>    |      |
| <i>Emmotum nitens</i>                   |    | <i>V.</i> <i>tucanorum</i>      | s    |
| <i>Euplassa inaequalis</i>              | m  | Lauraceae sp. 'Farinha Seca'    | t    |



In places nearby there is swampy forest (which appears similar to that of the Corrego da Onça transect 2, see p.44 ) with large numbers of trees of Xylopia emarginata and Mauritia flexuosa.

(b) Some of the tallest, best-structured forest on the Fazenda lies close to the Ribeirão de Gama near the main (northern) entrance of the Fazenda (see map 1, no.9). Unfortunately the time available for its examination was only a matter of hours and thus little information is available.

The forest has been cut back about 100 m to make a roça and has generally been much disturbed by human activity. The soil is well-drained and probably rather fertile.

The canopy is at more or less 15-25 m and the taller tree species noted are given in Table 16 (identifications are very rough and the list extremely incomplete). Many of the trees are giants of species normally encountered as smaller individuals, for example: Callisthene major 80 cm d.b.h. and  $\pm$  25 m tall, Qualea dichotoma 90 cm d.b.h. and  $\pm$  25 m tall, and Sclerolobium paniculatum 70 cm d.b.h. and  $\pm$  25 m tall - the largest specimens of these species I have ever seen. Amongst the vegetation of the forest floor the tall ginger Renealmia exaltata is conspicuous.

Table 16

Trees of the Ribeirão de Gama forest

|                                  |                                    |
|----------------------------------|------------------------------------|
| Alchornea iricurana              | Leguminosae sp. 'Jacaranda Cancil' |
| Amaioua guianensis               | Maprounea guianensis               |
| Aspidosperma sp. 'Quina da mata' | Myrtaceae sp. 'Araça da mata'      |
| Callisthene major                | Piptocarpha macropoda              |
| Cecropia sp.                     | Protium sp.                        |
| Cedrela odorata?                 | Qualea dichotoma                   |
| Combretaceae sp. 'Miringiba'     | Q. multiflora?                     |
| Copaifera langsdorfii            | Sclerolobium paniculatum           |
| Eugenia sp. 'Maria Preta'        | Tapirira guianensis                |
| Euterpe sp. 'Açaí'               | Vochysia pyramidalis               |
| Jacaranda caroba?                | Virola sp.                         |
| Lauraceae sp.                    | Family indet. sp. 'Cachimbeiro'    |

Lying just to the east of the Fazenda in the IBGE reserve and very close to the boundary fence is the cabeceira of an affluent (or perhaps the main stream) of the *Córrego Taquara*. Time did not allow any detailed examination of this cabeceira but it was noticed by mere examination through the fence that it contained many trees of *Piptadenia falcata*, indicating probably rather rich soils.

#### Characteristic species of the forest habitats

The transects and more general observations in the forests show the range to be seen on the Fazenda from swampy gallery (*Córrego da Onça*, T2), through intermediate conditions (T1), to drier cabeceira (T3 and *Córrego Capitinga Cabeceira*). As an aid to the student some of the most characteristic trees of each of the forest habitats are noted in Table 17.

Floristic differences between the flora of the *Córrego da Onça* and the *Córrego Capitinga* are striking and it is hoped that future research will elucidate their relationships to soils, vegetational history, etc.

Table 17

Characteristic tree species of the various forest habitats at Fazenda Agua Limpa

(for more complete lists see Tables 7 - 13 & 13)

d, drier habitats; w, damper habitats; s, small species; m, medium-sized species; t, tall species; vt, very tall species

| Very swampy forest<br>( <u>Córrego da Onça</u> ) |     | Drier parts of cabeceira<br>( <u>Córrego da Onça</u> )   |     |
|--------------------------------------------------|-----|----------------------------------------------------------|-----|
| Calophyllum brasiliense                          | t   | Copaifera langsdorfii                                    | vt  |
| Talauma ovata                                    | m   | Emmotum nitens                                           | t   |
| Xylopia emarginata                               | t   | Hirtella glandulosa                                      | t   |
| Virola urbaniana                                 | t   | Maprounea guianensis                                     | t   |
| Hedyosmum brasiliense                            | s   | Virola sebifera                                          | t   |
| Malanea macrophylla                              | s   | Lauraceae sp.                                            | t   |
| Palicourea sp. R3589                             | s   |                                                          |     |
| Swampy forest<br>( <u>Córrego da Onça</u> )      |     | Drier parts of cabeceira<br>( <u>Córrego Capitinga</u> ) |     |
| Cyathea sp. sens. lat.                           | s   | Amaioua guianensis                                       | m   |
| Guarea tuberculata                               | s-m | Apuleia molaris                                          | vt  |
| Hedyosmum brasiliense                            | s   | Aspidosperma sp. 'Guatambú'                              | t   |
| Mauritia flexuosa                                | t   | A. sp. 'Quina da mata'                                   | t   |
| Miconia chammissois                              | s   | Copaifera langsdorfii                                    | vt  |
| Pseudolmedia laevigata                           | t   | Maprounea guianensis                                     | t   |
| Protium spp.                                     | m-t | Piptocarpha macropoda                                    | t   |
| Tapirira guianensis                              | t   | Pouteria sp. R3848                                       | t   |
|                                                  |     | Salacia elliptica                                        | s-m |
|                                                  |     | Lauraceae sp. 'Farinha seca'                             | t   |

Table 17 (cont.)

| <u>Forest margin</u>     |      |                          |      |
|--------------------------|------|--------------------------|------|
| Andira sp.               | m    | Machaerium acutifolium   | dm   |
| Belangeria glabra        | t    | Maprounea guianensis     | s-td |
| Byrsonima umbellata      | sw   | Miconia chamissois       | s    |
| Callisthene major        | td   | Protium sp.              | t    |
| Didymopanax sp.          | mt   | Pseudolmedia laevigata   | t    |
| Euplassa inaequalis      | wm   | Qualea dichotoma         | t    |
| Ferdinandusa speciosa    | ws-m | Richeria obovata         | wt   |
| Gaylussacia brasiliensis | sw   | Sclerolobium paniculatum | td   |
| Hedyosmum brasiliense    | sw   | Styrax camporum          | m    |
| Hyptis cana              | s    | Tapirira guianensis      | t    |
| Ilex theezans            | s    | Tibouchina candolleana   | s    |
| Laplacea fruticosa       | t    | Vochysia tucanorum       | m    |

Fringing cerrado

|                     |                       |
|---------------------|-----------------------|
| Bombax longiflorum  | Plenckia populnea     |
| Dalbergia violacea  | Qualea multiflora     |
| Kielmeyera coriacea | Symplocos rhamnifolia |

Table 18

Species of the gallery forests

The numbers refer to where the species were noted:

1, Córrego da Onça; 2, Córrego Capitinga;  
3, Riberão de Gama forest. m = marginal

Trees & large shrubs

Anacardiaceae

Astronium fraxinifolium Schott. 2  
Tapirira guianensis Aubl. 1, 2, 3

Annonaceae

Cardiopetalum calophyllum Schlecht. 1  
Guatteria sellowiana Schlecht. 2  
G. sp. 1  
Xylopia aromatica Lam. 1, 2  
X. emarginata Mart. 1, 2  
X. sericea St. Hil. 2

Apocynaceae

Aspidosperma cf. pruinosa Mkgf. 2  
A. sp. 'Guatambú' 2  
A. sp. 'Quina da mata' 2, 3

Aquifoliaceae

Ilex theezans Mart. 1

Araliaceae

Didymopanax sp. 1, 2  
Gilibertia cf. cuneata March. 1, 2



Table 18 (cont.)

Bignoniaceae

Jacaranda caroba DC. 1, 2, 3  
 Tabebuia sp. 'Ipê amarelo' 1  
 T. sp. 'Pau de arco' 1

Bombacaceae

Bombax longiflorum K. Sch. 1, 2 (m)  
 B. martianum K. Sch. 1 (m)

Burseraceae

Protium spp. 1, 2, 3

Chloranthaceae

Hedyosmum brasiliense Mart. 1

Chrysobalanaceae

Hirtella glandulosa Spreng. 1, 2

Combretaceae

'Miringiba' 3

Compositae

Piptocarpha macropoda (DC.) Bak. 2, 3  
 Vernonia ruficoma Schlecht. 1  
 (caapoeira)

Cunoniaceae

Belangera glabra Camb. 1, 2

Cyatheaceae

Cyathea sp. sens. lat. 1

Ericaceae

Gaylussacia brasiliensis (Spr.)  
 Meissn. 1

Erythroxylaceae

Erythroxylum amplifolium (Mart.)  
 O.E. Sch. 1  
 E. sp. R3744, 1

Euphorbiaceae

Alchornea iricurana Casar. 1, 3  
 Maprounea guianensis Aubl. 1, 2, 3  
 Richeria obovata (M. Arg.) Pax & K.  
 Hoffm. 1, 2  
 Sebastiana scandens (Pax & K. Hoffm.)  
 Jablonski 1 (m)  
 Sapium obovatum [Klotzsch ex] M. Arg.  
 1, 2 (m)

Flacourtiaceae

Casearia grandiflora Camb. 2  
 C. sylvestris Sm. 2

Guttiferae

Calophyllum brasiliense Camb. 1  
 Clusia cruiva Camb. 1  
 C. sp. R3717 1  
 Rheedia sp.? 1

Hippocrateaceae

Cheiloclinum cognatum (Miers)  
 A.C. Sm. 2  
 Salacia elliptica (Mart.) Peyr. 2

Icacinaceae

Emmotum nitens (Benth.) Miers 1, 2

Labiatae

Hyptis cana [Pohl ex] Benth 2 (m)

Table 18 (cont.)

Lauraceae

- Licaria sp. R3604 1  
'Farinha seca' R3890V 2  
'Itaúba' 1  
'Louro branco' 1  
'Louro pitanga' R3887V 2  
'Louro precioso' 1

Leguminosae, Caesalpinoideae

- Apuleia molaris [Spruce ex] Benth. 2  
Bauhinia rufa (Bong.) Steud. 1  
Copaifera langsdorffii Desf. 1, 2  
Hymenaea stilbocarpa Hayne 2  
Sclerolobium paniculatum Vog. 1, 2, 3

Leguminosae, Mimosoideae

- Inga alba (Sw.) Willd. 2  
I. sp. 1  
Piptadenia falcata Benth. 2

Leguminosae, Papilionatae

- Andira sp. R3791 1, 2  
Machaerium acutifolium Vog. 1, 2  
Ormosia sp. R3872 1

Leguminosae, subfam. indet.

- 'Jacarandá cancel' 3

Magnoliaceae

- Talauma ovata St. Hil. 1

Malpighiaceae

- Byrsonima umbellata Adr. Juss. 1  
B. sp. R3842 1, 2

Melastomataceae

- Lavoisiera grandiflora Naud. 1 (m)  
Macairea macedoi Brade 1 (m)  
Miconia chammissois Naud. 1  
M. cf. chartacea Triana var.  
miqueliana Cogn. 1  
M. nervosa (Smith) Triana 1  
M. sellowiana Naud. 2  
Mouriri cf. glazioviana Cogn. 2  
Tibouchina candolleana (DC.) Cogn.  
1, 2 (m)  
Trembleya parviflora (Don) Cogn.  
subsp. triflora Cogn. 1, 2 (m)

Meliaceae

- Cabralea canjerana (Vell.) Mart.  
subsp. polytricha (A. Juss.)  
Pennington 2  
Cedrela odorata L. 1, 2, 3  
Guarea tuberculata Vell. 1

Monimiaceae

- Mollinedia sp. R3585 1, 2  
Siparuna cuyabana (Mart.) DC. 1, 2  
(m)  
S. guianensis Aubl. 1, 2

Moraceae

- Cecropia sp. 1, 2, 3  
Ficus spp. 1, 2  
Pseudolmedia laevigata Trec. 1  
Sorocea sp. 1, 2

Myristicaceae

- Virola sebifera Aubl. 1, 2  
V. urbaniana Warb. 1, 2

Table 18 (cont.)

Myrsinaceae

Cybianthus glaber A. DC. 1  
Weigeltia densiflora Mez 2 (m)

Myrtaceae

Eugenia cf. gamaeana Glaz. (nomen) 3  
Myrcia cf. deflexa (Rich.) DC. 1, 2  
M. cf. gardneriana Berg. 1 (m)  
M. cf. subrugosa Kiaersk. 1  
M. tomentosa (Aubl.) DC. 1, 2  
M. sp. R4277 1 (m)  
M. sp. 'Araçá da mata' 3  
'Folha miuda' 2  
'Murta' 1

Nyctaginaceae

Pisonia graciliflora Mart.? 2

Ochnaceae

Ouratea sp. 1

Onagraceae

Jussiaea brachyphylla Poir. 1 (m)

Palmae

Euterpe sp. 1  
Geonoma schottiana Mart. 1  
Mauritia flexuosa L.f. 1, 2

Piperaceae

Piper arboreum Aubl.? 1

Proteaceae

Euplassa inaequalis (Pohl) Engl.  
1, 2

Rhamnaceae

Rhamnus polymorpha (Reiss.) Weberb.  
1 (m)

Rosaceae

Rubus urticaeifolius Poir. 1 (m)

Rubiaceae

Alibertia sp.? R3844V 2  
Amaioua guianensis Aubl. 2, 3  
Ferdinandusa speciosa Pohl 1, 2  
Guettarda viburnoides C. & S. 1  
Malanea macrophylla Bartl. 1  
Palicourea sp. R3589  
R3847V 2

Sapindaceae

Cupania vernalis Camb. 2  
Matayba guianensis Aubl. 2 (m)

Sapotaceae

Pouteria sp. R3848 1, 2  
Sideroxylon venulosum [Mart. & Eichl.  
ex/ Miq. 2

Simarubaceae

Simaruba sp. 1

Solanaceae

Cestrum calycinum H. & B. 1

Styracaceae

Styrax camporum Pohl 1, 2

Symplocaceae

Symplocos nitens (Pohl) Benth. 1, 2  
S. variabilis Mart. 2

Table 18 (cont.)

Ternstroemiaceae

*Laplacea fruticosa* (Schrad.) Kobuski  
1

Verbenaceae

*Aegiphila sellowiana* Cham. 2

Vochysiaceae

*Callisthene major* Mart. 2, 3  
*Qualea dichotoma* (Mart.) Warm. 1, 2,  
3  
*Q. multiflora* Mart. 1, 3  
*Vochysia pyramidalis* (Spr.) Mart.  
1, 2, 3  
*V. tucanorum* (Spr.) Mart. 1, 2

Family indet.

'Cachimbeiro' 3  
'Embireira' 1  
'Quina' 1  
'Urucurana' 2  
R3634 1  
R3684 1  
Species 2-6 2

Lianas, herbaceous climbers & parasites

Asclepiadaceae

*Marsdenia* sp. R3745, 1  
R3787, 1

Compositae

*Mikania acuminata* DC. 1  
*M.* sp. 1  
*Piptocarpha* cf. *oblonga* Baker 2

Cucurbitaceae

*Cayaponia tayaya* Mart. var. *pallida*  
Cogn. 1 (m)  
*Gurania spinulosa* (Poepp. & Endl.)  
Cogn. 1

Dioscoreaceae

*Dioscorea marginata* Griseb.? 1, 2 (m)

Euphorbiaceae

*Sebastiania scandens* (Pax & K. Hoffm.)  
Jablonski 1, 2 (m)

Leguminosae, Papilionatae

*Phaseolus appendiculatus* Benth. 1  
(m)

Leguminosae, subfamily unknown

'Rabo de camaleão' R3881V 2  
'Rabo de camaleão' R3882V 2

Liliaceae

*Smilax syringoides* Griseb. 1

Malpighiaceae

*Mascagnia cordifolia* (Adr. Juss)  
Griseb. 2

Menispermaceae

*Cissampelos pareira* L. 1

Loranthaceae

*Phoradendron crassifolium* (Pohl)  
Endl. 1



Table 18 (cont.)

Orchidaceae

Vanilla sp. 1

Passifloraceae

Passiflora villosa Vell. 1 (m)

P. sp. 1

Polygonaceae

Coccoloba sp. R3781 1

Rosaceae

Rubus urticaefolius Poir. 1 (m)

Rubiaceae

Relbunium buxifolium K. Sch. 1 (m)

Sapindaceae

Serjania erecta Radlk. 1 (m)

S. spp. 1, 2

Paullinia sp. 1, 2

Solanaceae

Solanum sp. 1, 2

Vitaceae

Cissus cf. erosa Rich. 1

Herbs & small shrubs

Acanthaceae

Ruellia sp. R3873 1

Bignoniaceae

Jacaranda caroba (Vell.) DC. 1, 2 (m)

Commelinaceae

Commelina sp. 1, 2

Compositae

Eupatorium vautheranum DC. 1

Cyperaceae

Scleria arundinacea Kunth 1, 2 (m)

Gentianaceae

Leiphaimos sp. R3637 1

Gramineae

Ichnanthus bambusiflorus (Trin.)  
Doell 1

I. inconstans (Trin.) Doell 1

I. nemorosus (Swartz) Doell 1, 2

Panicum sp. 'Capim Bengó' 1, 2

Olyra latifolia L. 2

Melastomataceae

Lavoisiera cf. bergii Cogn. 1

Leandra melastomoides Raddi 2

Miconia hirtella Cogn. 2

Piperaceae

Piper sp. 1

P. sp. R3861 2

P. sp. R3862 2

Table 18 (cont.)

Rubiaceae

- Cephaelis glabrescens* (M. Arg.)  
Stanley 1, 2  
*Coccocypselum lanceolatum* (R. & P.)  
Pers. 1  
*Palicourea marcgravii* St. Hil. 1, 2  
*P. sp.* R3883V 2  
*Psychotria sp.* R3866 2  
*Rudgea sp.* 2

Solanaceae

- Brunfelsia obovata* Benth. subsp.  
*coriacea* (J.A. Schmidt) Plowman 1  
*Solanum sp.* R3867 2  
*S. sp.* R3901 2

Verbenaceae

- Lippia rotundifolia* C. & S. 1, 2 (m)

Zingiberaceae

- Renealmia exaltata* L.f. 1

Family indet.

- 'Espinho de Agulha' R3868V 2

Ferns (apart from Cynthea)

- |                                                      |                                                                                               |
|------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| <i>Blechnum sp.</i> 1, 2 (m)                         | <i>Lindsaea lancea</i> (L.) Bedd. 1                                                           |
| <i>Campyloneuron phyllitidis</i> (L.)<br>C. Presl 1  | <i>Polypodium fraxinifolium</i> Jacq. 1                                                       |
| <i>Christella sp.</i> R3546 1                        | <i>Pteridium aquilinum</i> (L.) Kuhn. var.<br><i>arachnoideum</i> (Kaulf.) Herter 1, 2<br>(m) |
| <i>Dicranopteris flexuosa</i> (Schrad.)<br>Underw. 1 | <i>Thelypteris sp. s.l.</i> R3631 1                                                           |
|                                                      | <i>Trichomanes crispum</i> L. agg. 1                                                          |

Roots and barks

A number of observations were made in the forest on interesting root and bark characters which are sometimes useful in identifying species.

Under swampy conditions buttress and surface roots are abundant on the forest floor and characterize various species. Hedyosmum brasiliense and young trees of Xylopia emarginata have conspicuous stilt roots; in the latter species they are sometimes borne up to 3 m above ground level, and in older trees appear to have coalesced with the expanding trunk to produce narrow, high buttresses. Tapirira guianensis has low buttresses which do not extend more than 30 cm up the trunk but radiate as surface roots over the forest floor; under swamp conditions Belangeria glabra has similar buttresses which, however, may extend 70 cm up the trunk and are thus more conspicuous. The latter species also produces breathing knee-roots (pneumatophores), but production of both these and buttresses appears to be facultative and

individuals growing in drier conditions produce neither. Euplassa inaequalis also has well-developed knee roots which form humps on the forest floor and carry prominent breathing-pegs bearing lenticels. Protium spp. have small buttresses or lobes at the base of the trunk, and this is also the case in Talauma ovata and Gilibertia cuneata when they are growing in extremely wet conditions (e.g. in soil which is already flooded in early October); in somewhat drier places the latter two species do not produce buttresses. Calophyllum brasiliense, which is a very abundant large tree under swampy conditions, sometimes has the trunk expanded at the base, like some species of palms, but never has buttress roots.

On better-drained soils buttress roots are seldom encountered, although they are still developed by Tapirira guianensis, Ficus spp. and, as already mentioned, Aspidosperma sp. 'Quina da mata', which has high narrow buttresses extending right up the trunk.

A number of species have very characteristic barks. Tapirira guianensis frequently has a pattern of transversely running ovoid-oblong scars which are apparently made by marmosets biting the bark to feed on gummy exudates. Calophyllum brasiliense has a regular pattern of short, vertical, presumably lenticellular fissures, whilst Talauma ovata has corky lenticellular outgrowths of the type seen in many Magnoliaceae. Pseudolmedia laevigata shows characteristic lumps on the trunk which often resemble a horse's knees and in these areas the bark, which is otherwise smooth, has a deep system of fissuring. In passing it is worth mentioning a very useful field character for identifying this species: the blaze exudes copious, pale milk-coffee coloured latex which turns to a dark brown-black colour after a short exposure to air. Many species such as the protiums have smooth barks but others have very characteristic patterns of fissuring and other peculiarities: in Maprounea guianensis, for instance, there is a pattern resembling massed barnacles which is often arranged in transverse bands around the trunk; Amaioua guianensis has fine longitudinal striations in the bark and frequently a spirally twisted lobing of the trunk; large specimens of Laplacea fruticosa, which despite the specific epithet reach 16 m tall and 40 cm d.b.h., have thick bark in a squared pattern; in thick old trees of Richeria obovata the bark has often scaled off the lower trunk leaving a completely smooth area - above there is a longitudinally striated bark. The last bark to be mentioned is that of Qualea dichotoma which is similar to that of the common 'Pau santo' (Kielmeyera coriacea).

Some trees can be identified very easily by colour or texture of foliage - this is particularly true of Laplacea fruticosa in which the old foliage turns a striking red.

#### NOTES ON SUCCESSION

A few very tentative thoughts on succession in the vegetation of the Fazenda seem worth recording.

The flora of the cerrado and cerradão reserves are obviously very closely related (see Table 1). The chief difference at the floristic level are the much reduced frequency of some cerrado species such as Kielmeyera coriacea and Ouratea acuminata in the cerradão, the great augmentation of others (e.g. Eugenia cf. gamaeana, Plathymenia reticulata and Copaifera langsdorfii) and the appearance of a characteristic cerradão element represented by Emmotum nitens, Nectandra lanceolata, Simaruba amara, Virola sebifera, Callisthene major, etc. These 'augmented' and characteristic cerradão species include the majority of the large dominant trees which produce the structure of the community. Some species of the cerradão, e.g. Emmotum nitens, Copaifera langsdorfii, Virola sebifera, Callisthene major, etc., are important constituents of the drier cabeceira forests where they are accompanied by characteristic forest species such as Amaioua guianensis, Cheiloclinum cognatum, Cupania vernalis, etc. It has already been suggested (p.53), on the evidence of relict trees, that cerrado has been succeeded by forest in the cabeceira of the Corrego Capitinga, and studies carried out in 1972 by a group of us in another area cast further light on this subject. The studies were made in cerradão and forest on the Papuda road, much of which was later destroyed because of the construction of the Escola Fazendária. In this locality, situated some 10 km from the sede of Fazenda Agua Limpa, cerradão with a floristic composition similar to, but rather richer than, that of the Fazenda thickens to produce an area of forest where many of the forest species important in the cabeceira of the Corrego Capitinga, such as Amaioua guianensis and Cheiloclinum cognatum, are common. The transformation of cerradão into forest observed in this area along a continuous transect to some extent parallels the difference between the disjunct cerradão and cabeceiras of the Fazenda.



There seems to be clear evidence that a seral succession from cerrado through cerradão of increasing density to forest occurs. When last examined by the writer, the cerrado area of Fazenda Agua Limpa had been an ecological reserve with protection from fire and grazing for over two years, and it was possible to see differences in the vegetation: myriads of tree saplings, which previously had been burned back each year were growing upwards and reaching a stage when they would soon be less vulnerable to fire. This process will lead to the thickening of the woody vegetation and no doubt after a number of years of protection to the establishment of a cerradão. Factors such as increased shade at ground level, as a result of the denser crown cover, may then allow establishment of the more exclusively cerradão species, and later, as the process continues, of true forest species.

In connexion with succession, the status of Maprounea guianensis in cerrado, cerradão and forest is particularly interesting. In the cerrado and cerradão of the Fazenda small shrubs of the form known as M. brasiliensis St. Hil. prior to the work of Allem (1976- see p.31) are abundant, while in the forest large canopy trees are found. It seems likely that the trees represent an exuberant development of the small shrubby form, possibly as a result of protection from fire, but it is also possible that there is some ecotypic differentiation of the two forms - clearly the problem requires further investigation.

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## APPENDIX 1

### Tentative key to the woody genera of dicotyledons of the cerrado

The key that follows attempts to provide a means of identification for all non-herbaceous genera of dicotyledons of the cerrado flora. Since in the cerrado it is frequently difficult to draw the line between herbs and small shrubs, users may find plants they consider herbs included and others they rank as shrubs excluded. In the main the genera covered follow the list given by Rizzini in Simposio sobre o cerrado (1963) and the figures given in brackets after each genus usually correspond to the number of species he gives; however, some genera additional to Rizzini's list are also included.

The key has been used by staff and students of the Laboratório de Ecologia, Universidade de Brasília, and the Depto de Botânica, Universidade de Campinas, with a high degree of success, and many modifications have been made in the light of this experience. Nevertheless it must be stressed that it is still in many places tentative, and the writer would be pleased to hear of any problems encountered in its use, suggested improvements, etc. It is planned to publish the key in Portuguese soon, and in fact Prof. Hermógenes de Freitas Leitão Filho of UNICAMP has already very kindly translated the key to the groups and families.

The key has been designed to identify only the cerrado species of the genera it encompasses and will not necessarily provide correct determinations of the non-cerrado species of the same genera. General keys to the families of Brazilian vascular plants are given in Joly, A.B. (1975), Botânica, chaves de identificação das famílias de plantas vasculares que ocorrem no Brasil (Ed. USP), while Barroso, G.M. (1978 onwards), Sistemática de angiospermas do Brasil (Ed. USP) which is being published in parts gives keys to the genera.



TENTATIVE KEY TO THE WOODY GENERA  
OF DICOTYLEDONS OF THE CERRADO

Key to the Groups

1. All flowers unisexual ..... Group E (p.78)
- + At least some flowers hermaphrodite ..... 2
  
2. Perianth of two (or rarely more) distinct whorls,  
differing markedly from each other in size, shape or colour ..... 3
- + Perianth 0, or one of whorl, or of two or more similar  
whorls ..... Group D (p.77)
  
3. Petals united, at least at the base ..... Group C (p.75)
- + Petals free ..... 4
  
4. Gynaeceum superior ..... Group A
- + Gynaeceum inferior ..... Group B (p.74)

Group Keys

Group A. All of the petals free at  
the base, gynaeceum superior.

1. Gynaeceum apocarpous; styles free ..... 2
- + Gynaeceum syncarpous or monocarpellary, or apocarpous  
with a united style ..... 5
  
2. Perianth consisting of a calyx of two cup-like sepals  
and 6 to numerous almost linear petals ..... Winteraceae  
(Drimys) (p.103)
- + Perianth not as above ..... 3
  
3. Perianth of three whorls ..... Annonaceae (p.81)
- + Perianth of two whorls ..... 4
  
4. Leaves simple, often sandpapery ..... Dilleniaceae (p.85)
- + Leaves pinnate ..... Connaraceae (p.85)
  
5. Sepals and petals 4; stamens many; ovary borne on  
long gynophore ..... Capparidaceae  
(Capparis) (p.103)
- + Not having the above combination of characters ..... 6
  
6. Sepals 2-3, unequal, reflexed; petals 5, cucullate,  
terminating in a biforked linear appendage; staminal  
filaments fused below, terminating in 5 branches each  
bearing a cluster of 3 anthers ..... Sterculiaceae  
(Guazuma) (p.100)
- + Not having the above combinations of characters ..... 7

|     |                                                                                                                                                          |                                     |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| 7.  | Styles free .....                                                                                                                                        | 8                                   |
| +   | Styles united, at least for part of their length, or style 1 ..                                                                                          | 16                                  |
| 8.  | Leaves opposite .....                                                                                                                                    | 9                                   |
| +   | Leaves alternate .....                                                                                                                                   | 11                                  |
| 9.  | Leaves ternate .....                                                                                                                                     | Caryocaraceae                       |
|     |                                                                                                                                                          | (Caryocar) (p.103)                  |
| +   | Leaves simple .....                                                                                                                                      | 10                                  |
| 10. | Styles 5; stamens in bundles with fused filaments;<br>sepals glandular-punctate .....                                                                    | Guttiferae                          |
|     |                                                                                                                                                          | (Vismia) (p.85)                     |
| +   | Styles 3; stamens free; sepals bearing large, conspicuous,<br>often paired, glands .....                                                                 | Malpighiaceae (p.93)                |
| 11. | Leaves compound .....                                                                                                                                    | 12                                  |
| +   | Leaves simple .....                                                                                                                                      | 13                                  |
| 12. | Leaves pinnate .....                                                                                                                                     | Anacardiaceae (p.80)                |
| +   | Leaves ternate .....                                                                                                                                     | Oxalidaceae (p.103)                 |
| 13. | Petals with an appendage on the inner surface .....                                                                                                      | Erythroxylaceae (p.103)             |
| +   | Petals without an appendage on the inner surface .....                                                                                                   | 14                                  |
| 14. | Staminal filaments fused at least at the base or<br>flower with a long androgynophore .....                                                              | Sterculiaceae (p.100)               |
| +   | Not as above .....                                                                                                                                       | 15                                  |
| 15. | Styles 2 .....                                                                                                                                           | Dilleniaceae (p.85)                 |
| +   | Styles 5 .....                                                                                                                                           | Ternstroemiaceae                    |
|     |                                                                                                                                                          | (Laplacea) (p.101)                  |
| 16. | Perianth obviously zygomorphic .....                                                                                                                     | 17                                  |
| +   | Perianth actinomorphic .....                                                                                                                             | 22                                  |
| 17. | Androecium of one stamen .....                                                                                                                           | Vochysiaceae (p.102)                |
| +   | Androecium of more than one stamen .....                                                                                                                 | 18                                  |
| 18. | Ovary unilocular .....                                                                                                                                   | 19                                  |
| +   | Ovary bi- or trilocular .....                                                                                                                            | 20                                  |
| 19. | Corolla papilionate, or subpapilionate; all or<br>9 of the staminal filaments fused for at least one third<br>their length (rarely all filaments free).. | Leguminosae, Papilionatae (p.91)    |
| +   | Corolla not papilionate; staminal filaments free or<br>only fused at the very base .....                                                                 | Leguminosae, Caesalpinoideae (p.89) |
| 20. | Leaves compound; stamens free .....                                                                                                                      | Sapindaceae (p.99)                  |
| +   | Leaves simple; staminal filaments united (monadelphous) .....                                                                                            | 21                                  |
| 21. | Ovary bilocular; calyx with two much enlarged lateral<br>petaloid sepals; leaves alternate .....                                                         | Polygalaceae (p.103)                |
| +   | Ovary trilocular; calyx sepaloid, not as above;<br>leaves opposite .....                                                                                 | Trigoniaceae (p.103)                |

|     |                                                                                                                                                                |                                           |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| 22. | Receptacle forming a cup or tube .....                                                                                                                         | 23                                        |
| +   | Receptacle not as above .....                                                                                                                                  | 27                                        |
| 23. | Leaves opposite .....                                                                                                                                          | 24                                        |
| +   | Leaves alternate .....                                                                                                                                         | 25                                        |
| 24. | Leaves multicostate; anthers dehiscing by pores; connective<br>often developed into variously shaped appendages ... Melastomataceae (p.94)                     |                                           |
| +   | Leaves unicostate; anthers dehiscing by slits;<br>connective not as above ..... Lythraceae (p.87)                                                              |                                           |
| 25. | Stamens 5, inserted opposite the small, narrow-based petals;<br>ovary bi- or trilocular .....                                                                  | Rhamnaceae (p.96)                         |
| +   | Stamens 3-many, if 5 then not opposite the petals;<br>ovary unilocular (very rarely bilocular) .....                                                           | 26                                        |
| 26. | Leaves simple; ovary with lateral or terminal stigma .....                                                                                                     | Rosaceae (p.98)                           |
| +   | Leaves compound; stigma always terminal .....                                                                                                                  | Leguminosae,<br>Caesalpinoideae (p.89)    |
| 27. | Leaves compound .....                                                                                                                                          | 28                                        |
| +   | Leaves simple .....                                                                                                                                            | 35                                        |
| 28. | Leaves palmate; staminal filaments united,<br>anthers unilocular .....                                                                                         | Bombacaceae (p.83)                        |
| +   | Leaves ternate, pinnate, or bipinnate; staminal<br>filaments united or not .....                                                                               | 29                                        |
| 29. | Ovary unilocular .....                                                                                                                                         | 30                                        |
| +   | Ovary multilocular .....                                                                                                                                       | 31                                        |
| 30. | Leaves pinnate or ternate; staminal filaments free;<br>ovules 2, collateral; seed arillate .....                                                               | Connaraceae (p.85)                        |
| +   | Leaves bipinnate, or if simply pinnate then staminal<br>filaments fused to form a tube; ovules never<br>collateral; seed without an aril .....                 | Leguminosae,<br>Mimosoideae (p.88)        |
| 31. | Flowers small, to 4 mm diam., brownish or greenish,<br>in tight axillary clusters; crushed leaves, cut bark,<br>etc., very aromatic .....                      | Burseraceae<br>( <u>Protium</u> ) (p.103) |
| +   | Not as above .....                                                                                                                                             | 32                                        |
| 32. | Staminal filaments flattened and scale-like (or bearing<br>scales), often fused to form a tube; if filaments free<br>then a short androgynophore present ..... | 33                                        |
| +   | Not as above .....                                                                                                                                             | 34                                        |
| 33. | Ovary entire; stigma usually discoid, approaching the<br>diameter of the ovary; fruit a capsule or drupe .....                                                 | Meliaceae (p.94)                          |
| +   | Ovary lobed; stigma usually small and lobed, much<br>narrower than the ovary; fruit simple, one-seeded or<br>a group of follicles .....                        | Simarubaceae (p.100)                      |
| 34. | Leaves glandular-punctate; plant often very aromatic .....                                                                                                     | Rutaceae (p.99)                           |
| +   | Not as above .....                                                                                                                                             | Sapindaceae (p.99)                        |



35. Stamens more than twice as many as petals ..... 36  
+ Stamens twice as many as petals, or fewer ..... 40
36. Ovary unilocular ..... 37  
+ Ovary multilocular ..... 38
37. Ovules many on parietal placentas; anthers dehiscing by  
terminal pores; leaves palmatisect ..... Cochlospermaceae (p.103)  
+ Ovules 2; anthers dehiscing by slits; leaves entire ... Dilleniaceae  
(Davilla) (p.85)
38. Staminal filaments connate below; connective forming  
a pointed appendage usually larger than the anther  
loculi ..... Humiriaceae (p.87)  
+ Filaments free, or if fused then connective  
not forming an appendage larger than the anther loculi ..... 39
39. Leaves exstipulate, leathery, unicostate; calyx imbricate;  
epicalyx absent ..... Ternstroemiaceae  
(incl. Kielmeyera) (p.101)  
+ Leaves stipulate (stipules sometimes caducous and  
then leaves apparently exstipulate); lateral veins  
so prominent as to give a pseudo-multicostate  
appearance; calyx valvate; epicalyx sometimes present ..... Tiliaceae (p.101)
40. Stamens and ovary borne on a long androgynophore ..... Sterculiaceae  
(Helicteres) (p.100)  
+ Not as above..... 41
41. Stamens as many as the petals or fewer ..... 42  
+ Stamens twice as many, or almost twice as many, as the petals ... 49
42. Stamens 3 ..... Hippocrateaceae  
(Salacia) (p.103)  
+ Stamens more than 3 ..... 43
43. Stamens opposite the petals ..... 44  
+ Stamens alternate with the petals ..... 46
44. Calyx very short, often forming a mere ring; petals valvate,  
often forming a caducous cap ..... Vitaceae  
(Cissus) (p.103)  
+ Calyx well developed; petals not as above ..... 45
45. Stamens free; sepals much exceeding the small, narrow-based  
petals ..... Rhamnaceae (p.96)  
+ Staminal filaments fused, at least below; sepals usually  
shorter than the petals ..... Sterculiaceae  
(Melochia & Waltheria) (p.100)
46. Ovary 5-locular; petals acute with a narrow, conspicuously  
inflexed tip; plant glandular-punctate ..... Rutaceae  
(Hortia) (p.99)  
+ Not with the above combination of characters ..... 47



47. Ovary and the inner surface of the petals conspicuously hairy; connective produced above anther loculi into an apiculate tip ..... Icacinaceae (Emmotum) (p.103)
- + Ovary and petals not conspicuously hairy; connective not as above ..... 48
48. Disc well-developed, surrounding the ovary; fruit dry, winged (samara) ..... Celastraceae (Plenckia) (p.103)
- + Disc absent; fruit a drupe ..... Aquifoliaceae (Ilex) (p.103)
49. Anthers dehiscing by pores ..... 50
- + Anthers dehiscing by slits ..... 51
50. Ovary trilocular, shallowly lobed; each loculus multiovulate ..... Clethraceae (Clethra) (p.103)
- + Ovary deeply 5-lobed or completely divided into 5 carpels with a united style; carpels (loculi) uniovulate ..... Ochnaceae (Ouratea) (p.103)
51. Ovary unilocular, uniovulate; receptacle swelling in fruit to form a fleshy body ..... Anacardiaceae (Anacardium) (p.80)
- + Ovary multilocular; receptacle in fruit not as above ..... 52
52. Stamens connate below; connective forming a pointed appendage above the anther loculi; petals not conspicuously hairy on inner surface; sepals with marginal glands ..... Humiriaceae (Sacoglottis) (p.87)
- + Stamens not connate, sometimes adhering to the petals; connective not as above; petals with conspicuous hairy tufts on the inner surface; sepals without marginal glands ..... Olacaceae (p.96)

#### Group B

All of the petals free at the base,  
gynaeceum inferior

1. Stamens more than twice the number of petals ..... 2
- + Stamens twice the number of petals, or fewer ..... 3
2. Part of the androecium on one side forming a petaloid 'helmet' bearing staminodes; fruit large, woody, opening by a detachable lid; leaves alternate ..... Lecythidaceae (Lecythis) (p.103)
- + Petaloid androecial helmet absent; fruit usually fleshy; leaves usually opposite ..... Myrtaceae (p.95)

3. Leaves simple, multicostate, with a conspicuous system of transverse interconnecting veins, or if unicostate connective developed into a spur or swelling below the anther loculi; stamens never 5 opposite the petals ..... Melastomataceae (p.94)
- + Leaves simple and unicostate, or compound, or if multicostate stamens 5 opposite the petals ..... 4
4. Leaves opposite; stamens more than 5; flowers in sessile spikes; fruit with four wings ..... Combretaceae (Combretum) (p.84)
- + Leaves alternate; stamens 5; inflorescence and fruit not as above ..... 5
5. Stamens opposite the small, narrow-based petals; leaves simple with three main veins ..... Rhamnaceae (Zizyphus) (p.96)
- + Stamens alternating with the petals; leaves either palmately compound or simple and unicostate ..... Araliaceae (p.82)

#### Group C

##### Petals united, at least at the base

1. Ovary inferior..... 2
- + Ovary superior ..... 4
2. Flowers aggregated in a capitulum; calyx represented by a hairy pappus; anthers usually united; ovary unilocular, uniovulate ..... Compositae (p.84)
- + Flowers separate, or if aggregated in a capitulum calyx not represented by a hairy pappus and anthers never united ..... 3
3. Leaves opposite or whorled; stipules various, often interpetiolar; stamens 4 or 5 ..... Rubiaceae (p.97)
- + Leaves alternate, exstipulate; stamens 5 to many ..... Symplocaceae (Symplocos) (p.103)
4. 'Calyx' of 3 free sepals (bracteoles); 'corolla' tubular, 5-lobed or -toothed at the apex, urceolate and fleshy or + straight-sided and villous; stamens 5-10 hypogynous; ovary unilocular, uniovulate; stigma sometimes laciniate ..... Nyctaginaceae (p.95)
- + Not with the above combination of characters ..... 5
5. Gynaeceum monocarpellary, unilocular; androecium various, often monadelphous; leaves 2-compound, if simply pinnate then rachis winged and stamens many and monadelphous; fruit a legume of various types ..... Leguminosae, Mimosoideae (p.88)
- + Not with the above combination of characters ..... 6
6. Stamens more numerous than the corolla lobes ..... 7
- + Stamens the same number as the corolla lobes or fewer ..... 10



7. Leaves compound ..... 8
- + Leaves simple ..... 9
  
8. Leaves ternate, opposite ..... Caryocaraceae  
(Caryocar) (p.103)
- + Leaves digitate, alternate ..... Bombacaceae (p.83)
  
9. Stamens 10; anthers longer than the filaments ..... Styracaceae  
(Styrax) (p.100)
- + Stamens usually more than 10; anthers shorter  
than the filaments ..... Symplocaceae (p.103)
  
10. Fertile stamens opposite the corolla lobes .....11
- + Fertile stamens alternating with the corolla lobes .....13
  
11. Staminodial scales (or lobes) alternating with the corolla  
lobes; milky latex present ..... Sapotaceae (p.103)
- + Staminodes absent; milky latex absent .....12
  
12. Corolla rotate; ovary unilocular; floral parts  
usually with an indumentum of tiny scales or orange  
streaks or spots ..... Myrsinaceae (p.95)
- + Corolla tubular with reflexed lobes; ovary trilocular;  
floral parts lacking a scaly indumentum but with a  
tuft of hairs on the corolla outside each anther .....Olacaceae  
(Schoepfia) (p.96)
  
13. Fertile stamens 4 (didynamous) with the posterior stamen  
either completely absent or represented by a staminode;  
perianth often zygomorphic ..... 14
- + Fertile stamens 5, or if 4 then equal in number to the  
corolla lobes; perianth actinomorphic ..... 16
  
14. Style gynobasic; ovary quadrilocular with 1 ovule per locus;  
posterior staminode absent ..... Labiatae (p.103)
- + Style terminal; ovary bi- or quadrilocular; the posterior  
stamen often represented by a staminode ..... 15
  
15. Ovules numerous in each locus; ovary bilocular, never  
quadrilocular ..... Bignoniaceae (p.83)
- + Ovules one or two per locus; ovary bi- or  
quadrilocular .....Verbenaceae (p.102)
  
16. Ovary tri- or quadrilocular ..... 17
- + Ovary bilocular (very rarely unilocular) or with two  
separate carpels united by a common style ..... 19
  
17. Ovary trilocular; style simple bearing a 3-lobed stigma;  
staminal filaments expanded and connate below to form a  
corona-like structure with expanded connectives forming  
terminal lobes ..... Styracaceae  
(Pamphilia) (p.100)
- + Ovary quadrilocular; style bifid or twice bifid;  
staminal filaments not expanded and connate below .....18
  
18. Leaves alternate; style twice bifid bearing 4 stigmas...Boraginaceae  
(Cordia) (p.103)
- + Leaves opposite; style bifid bearing 2 stigmas ..... Verbenaceae (p.102)

19. Corolla rotate; anthers dehiscing by apical pores and forming a conspicuous exserted group; fruit a berry, often very large; leaves alternate ..... Solanaceae (Solanum) (p.103)
- + Corolla  $\frac{1}{2}$  tubular; anthers not as above; fruit usually dry, if fleshy then leaves always opposite or whorled ..... 20
20. Stigma usually consisting of an expanded body with a two-pronged tip; corolla lobes twisted in the bud; latex often present; fruit often of two separate follicles ..... Apocynaceae (p.82)
- + Stigma capitate or bilobed, not prolonged at the tip; corolla lobes valvate; latex absent; fruit never two separate follicles ..... Loganiaceae (p.87)

#### Group D

Perianth 0, or of 1 whorl, or 2 or more

#### similar whorls

1. Gynaeceum inferior ..... 2
- + Gynaeceum superior ..... 4
2. Leaves palmately compound ..... Araliaceae (Didymopanax) (p.82)
- + Leaves simple or absent ..... 3
3. Leaves fleshy or absent; flowers large, solitary; perianth polymeric; stamens many; plant spiny ..... Cactaceae (p.84)
- + Leaves not fleshy; flowers small, aggregated in inflorescences; perianth 4- or 5-merous, or apparently absent; stamens 10; plant unarmed ..... Combretaceae (p.84)
4. Ovary multiovulate; stamens 10 to many ..... Flacourtiaceae (p.85)
- + Ovary with only 1 or 2 ovules; stamens never more than twice the number of perianth members ..... 5
5. Stamens borne on the tepals, usually near the tips ..... Proteaceae (p.96)
- + Stamens not epitepalous ..... 6
6. Leaves pinnate; perianth 4; stamens 8; receptacle not forming a perigynous cup ..... Leguminosae, Caesalpinoideae (Copaifera) (p.89)
- + Leaves simple; perianth not as above; receptacle forming a perigynous cup or not ..... 7
7. Flowers often borne in groups of 3; perianth a tube, 5-lobed or -toothed above, sometimes urceolate and fleshy, or villous; stigma often laciniate; receptacle not cup-shaped ..... Nyctaginaceae (p.95)
- + Not as above; receptacle cup-shaped ..... 8



8. Leaves exstipulate; perianth members 6; stamens 3  
or a multiple of 3; dehiscence of anthers by valves  
opening from below upwards; style terminal ..... Lauraceae (p.87)
- + Leaves stipulate; perianth members 5; stamens not  
usually in multiples of 3; dehiscence of anthers  
by slits; style lateral ..... Rosaceae (p.98)

#### Group E

Flowers unisexual (although vestiges of the  
organs of the other sex often present)

1. Leaves pinnate; vestigial organs of other sex often  
present so flower appears hermaphrodite ..... 2
- + Leaves simple; vestigial organs of other sex present  
or not ..... 5
2. Leaves gland-dotted, sometimes bearing thorns; trunk  
covered in conical thorns ..... Rutaceae  
(Fagara) (p.99)
- + Leaves not gland-dotted; leaves and trunk unarmed ..... 3
3. Filaments of stamens and staminodes flattened to  
form an appendaged scale-like base; ovary 5-locular ... Simarubaceae  
(Simaruba) (p.100)
- + Filaments of stamens and staminodes not as above;  
ovary uni- or trilocular ..... 4
4. Ovary in female flowers unilocular; disc little  
developed; flowers actinomorphic ..... Anacardiaceae (p.80)
- + Ovary in female flowers trilocular; disc well  
developed; flowers often zygomorphic ..... Sapindaceae (p.99)
5. Two differing perianth whorls (calyx and corolla)  
present ..... 6
- + Perianth absent, or of one whorl, or two similar  
whorls ..... 13
6. Indumentum of stellate hairs or peltate scales  
present; ovary of female flowers with 3 uniovulate  
loculi and styles usually divided into 6 or more  
branches ..... Euphorbiaceae  
(Croton) (p.86)
- + Not with the above combination of characters ..... 7
7. Flowers gamosepalous and gamopetalous ..... 8
- + One or both perianth whorls free ..... 10

8. Leaves alternate; stamens in male flowers more numerous than corolla lobes; ovary in female flowers superior with 4-12 uniovulate loculi, conspicuously hairy ..... Ebenaceae  
(Diospyros) (p.85)
- + Leaves opposite; stamens in male flowers equal in number to the corolla lobes; ovary in female flowers superior or inferior, not more than 4-locular, not conspicuously hairy ..... 9
9. Interpetiolar stipules present; calyx truncate; ovary of female flowers inferior; stamens of male flowers sessile ..... Rubiaceae  
(Alibertia incl. Thielodoxa) (p.97)
- + Interpetiolar stipules absent; calyx 4-lobed; ovary of female flowers superior; stamens of male flowers exerted with long filaments ..... Verbenaceae  
(Aegiphila) (p.102)
10. Stamens in male flowers many; ovary in female flowers with 5 or more multiovular loculi and an equal number of sessile stigmata ..... Guttiferae  
(Clusia) (p.85)
- + Stamens in male flowers 4-10; ovary in female flowers unilocular and uniovulate ..... 11
11. 'Calyx' consisting of 3 separate leaves (bracteoles); 'corolla' united, tubular; stamens in male flowers usually more than 5; style of female flowers slender, often with a laciniate stigma ..... Nyctaginaceae (p.95)
- + Not with the above combination of characters .....12
12. Dioecious; calyx gamosepalous, 4-5-lobed; petals free; stigma in female flowers sessile, + as broad as the ovary; stamens in male flowers 4 or 5, inserted opposite the petals; leaves acute-lanceolate ..... Opiliaceae  
(Agonandra) (p.103)
- + Polygamous; calyx and corolla free, each of 5 members; style in female flower long, slender, curved near tip; stamens 10, often of very different sizes in male flowers; leaves rounded at the apex ..... Anacardiaceae  
(Anacardium) (p.80)
13. Flowers arranged in a complex globose or pyriform inflorescence; either both male and female lining the hollow receptacle (Ficus) or male covering the surface of the receptacle in which a few female flowers are immersed (Brosimum); plant laticiferous ..... Moraceae (p.94)
- + Inflorescences various, not as above, plant laticiferous or not .....14
14. Perianth of 6 members; receptacle cup-shaped; anthers of male flowers dehiscent by valves opening from below upwards; ovary of female flowers unilocular and uniovulate; fruit with an investing cupule below ..... Lauraceae (p.87)
- + Not with the above combination of characters .....15

15. Female flowers present .....16
- + Female flowers absent .....18
16. Ovary trilocular; each loculus with one or two ovules;  
plants usually monoecious; male flowers often with a  
well-developed disc ..... Euphorbiaceae (p.86)
- + Ovary unilocular, uniovulate; plant dioecious .....17
17. Perianth with ferrugineous tomentum, tubular, enclosing  
the ovary, 3-lobed at the apex; disc absent ..... Myristicaceae  
(Viola) (p.103)
- + Perianth forming a shallow-lobed ring about the base  
of the ovary, not ferrugineous-tomentose; disc present,  
also surrounding the base of the ovary ..... Opiliaceae  
(Agonandra) (p.103)
18. Perianth with ferrugineous tomentum, tubular, apex  
3-lobed; stamens, including anthers, connate, forming  
a united column ..... Myristicaceae  
(Viola) (p.103)
- + Perianth various but never as above; stamens various  
but never with connate anthers..... Euphorbiaceae (p.86)

#### Anacardiaceae

1. Leaves simple ..... Anacardium (6 spp.)
- + Leaves pinnate ..... 2
2. Leaf rachis unwinged ..... 3
- + Leaf rachis winged ..... 5
3. Fruit a samara; leaflets generally less than 2.5 cm,  
rounded or emarginate at the apex ..... Schinopsis (1 spp.)
- + Fruit unwinged (although sometimes surrounded by  
a persistent scarious perianth); leaflets more  
than 2.5 cm, acute or apiculate ..... 4
4. Fruit a fleshy drupe not surrounded by a scarious  
perianth; tree usually evergreen; leaves generally  
3(-4)-jugate; leaflets with an equal cuneate base ..... Tapirira (2 spp.)
- + Fruits coriaceous, surrounded by a persistent  
scarious perianth (perianth of male flowers also  
scarious); tree frequently flowering and fruiting  
when leafless; leaves generally 4-jugate or more;  
leaflets often with an asymmetrical abruptly  
contracted base ..... Astronium (2 spp.)
5. Leaves 1-3-jugate; leaflets more than 4 cm,  
margins entire ..... Lithraea (2 spp.)
- + Leaves usually more than 3-jugate; leaflets less  
than 4 cm, margins toothed ..... Schinus (2 spp.)



# Annonaceae

1. Sepals at anthesis about as long as the petals and enclosing them; anthers transversely septate ..... Cardiopetalum (1 sp.)
- + Sepals at anthesis considerably shorter than the petals; anthers transversely septate or not ..... 2
2. Petals basally expanded, very long and narrow and at least the inner held erect; anthers transversely septate ..... Xylopia (2 spp.)
- + Petals various but not as above; anthers non-septate ..... 3
3. Petals imbricate ..... 4
- + At least the outer petals valvate ..... 6
4. Indumentum of peltate scales or stellate hairs present ..... Duguetia (6 spp.)
- + Indumentum, if present, not as above ..... 5
5. Connective elongated into a triangular or lanceolate appendage above the anthers; sepals imbricate ..... Oxandra
- + Connective expanded into a truncate disc above the anthers; sepals valvate ..... Guatteria (2 spp.)
6. Outer petals without wings or spurs ..... Annona (9 spp.)
- + Outer petals connate and produced into wings and spurs ..... Rollinia (1 sp.)

## Key based on fruits (and vegetative characters)

1. Fruiting carpels fused to form a fleshy or dry syncarp ..... 2
- + Fruiting carpels (monocarps) free ..... 3
2. Ripe fruit dry, woody; undersurface of leaves with lepidote or stellate indumentum ..... Duguetia
- + Ripe fruit fleshy; undersurface of leaves without lepidote indumentum ..... Annona,  
Rollinia  
(separate on  
petal characters  
if available)
3. Monocarps 1-seeded ..... 4
- + Monocarps 2 to many-seeded ..... 5
4. Monocarps stipitate ..... Guatteria (2 spp.)
- + Monocarps <sup>+</sup> sessile ..... Oxandra
5. Pedicels with bracteoles ..... Xylopia (2 spp.)
- + Pedicels without bracteoles ..... Cardiopetalum (1 sp.)



## Apocynaceae

1. Fruit fleshy ..... 2
- + Fruit follicular ..... 3
  
2. Ovary unilocular; fruit a berry; latex white, copious  
(enough to produce rubber); shrub or small tree ..... Hancornia (1 sp.)
- + Ovary bilocular; fruit a drupe; latex less copious  
than the above; subshrub ..... Rauwolfia (1 sp.)
  
3. Seeds winged ..... 4
- + Seeds unwinged ..... 5
  
4. Inflorescence a paniculate cyme, often very crowded;  
follicles much compressed; much less than 10 x as long  
as broad; latex sparse ..... Aspidosperma (9 spp.)
- + Inflorescence simple, appearing articulate;  
follicles little compressed, at least 10 x as long as  
broad; latex copious ..... Himatanthus (3 spp.)
  
5. Seeds with a conspicuous tuft of hairs at the  
micropylar end ..... 6
- + Seeds lacking such a tuft of hairs ..... 8
  
6. Inflorescence racemose (with opposite flowers) ..... Haemadictyon (1 sp.)
- + Inflorescence a paniculate cyme ..... 7
  
7. Flowers small, in crowded clusters ..... Forsteronia (1 sp.)
- + Flowers large, individually conspicuous, not  
crowded ..... Odontadenia (2 spp.)
  
8. Fruits constricted and disarticulating between seeds  
(lomentaceous) ..... Condylocarpon (1 sp.)
- + Fruits not constricted between the seeds (follicular) .. Peschiera (2 spp.)

## Araliaceae

1. Leaves palmately compound ..... Didymopanax (Schefflera) (7 spp.)
- + Leaves simple ..... Gilibertia (1 sp.)

## Bignoniaceae

1. Leaves pinnate or bipinnate ..... 2
- + Leaves simple, bifoliolate (often with terminal  
tendrils), ternate or palmately compound ..... 3
  
2. Trees, shrubs, or subshrubs, never climbing; flowers  
usually blue or violet; capsule orbicular or oblong,  
angustiseptate, very woody ..... Jacaranda (7 spp.)
- + Subshrub or climber; flowers yellow; capsule  
elongate, latiseptate ..... Memora (1 sp.)
  
3. Leaves simple, bifoliolate (often with terminal tendril)  
or ternate; shrubs or climbers ..... 4
- + Leaves palmately compound; trees or erect little-branched  
shrubs ..... 7
  
4. Leaves simple, bifoliolate or ternate; capsule elongate,  
linear, at least 10 x as long as broad ..... Arrabidaea (2 spp.)
- + Leaves bifoliolate, often with terminal tendril, or  
ternate; capsule  $\pm$  oblong, ovate, or elliptic, less  
than 10 x as long as broad ..... 5
  
5. Leaves ternate, without tendrils; flowers in small axillary  
groups; capsule elliptic, c. 2 x as long as broad ... Anemopaegma
- + Most leaves bifoliolate, often with terminal tendrils,  
although ternate leaves also often present; inflorescence  
a terminal panicle; capsule c. 3-4 x as long as broad ..... 6
  
6. Calyx 5-toothed or-lobed, often glandular-punctate;  
bracts large, exceeding the calyx in length; fruit-  
valves tuberculate; seeds with wing little  
developed ..... Adenocalymma (1 sp.)
- + Calyx truncate, never glandular-punctate; bracts  
small, shorter than the calyx; fruit-valves smooth;  
seeds with a broad membranous wing ..... Distictella (1 sp.)
  
7. Trees or thick, woody-stemmed shrubs; corolla  
glabrous on the outside; capsule elongate, linear;  
valves smooth, glabrous or with an indumentum of  
small hairs ..... Tabebuia (5 spp.)
- + Erect, slender, little-branched shrub; outside of  
corolla covered with a matted stellate tomentum;  
capsule suborbicular, flattened; valves covered with  
thick tubercles ..... Zehyera (1 sp.)

## Bombacaceae

1. Staminal tube entire; anthers 5, ditheous;  
leaflets serrate ..... Chorisia (1 sp.)
- + Staminal tube divided above into many filaments;  
anthers many, monotheous; leaflets entire.... Bombax sens.lat. (11 spp.)

### Cactaceae

1. Plant with the habit of a normal dicotyledon; leaves flat, persistent; groups of spines occurring on the stem at the bases of the leaves ..... Pereskia (1 sp.)
- + Plant an upright stem-succulent with glochidia occurring in many vertical rows; no flat foliage leaves present ..... Cereus (? spp.)

### Combretaceae

1. Petals present; fruit with 4 equally developed wings .. Combretum (1 sp.)
- + Petals absent; fruit not as above ..... 2
2. Calyx divided into distinct lobes; anthers versatile; fruit 2-winged, or if 3-5-winged then 2 much larger than the others ..... Terminalia (5 spp.)
- + Margin of calyx almost entire; anthers adnate, immobile; fruit a 5-angled drupe ..... Buchenavia (1 sp.)

### Compositae

1. Tree or large shrub with thick, often very tomentose, Pseudobombax-like stems; often flowering when leafless; capitula very large, 4-12 cm diam.; rocky habitats .. Wunderlichia (3 spp.)
- + Not as above ..... 2
2. Capitula few-flowered; arranged in tight groups (glomerules) looking superficially like capitula themselves ..... 3
- + Capitula larger, not aggregated in glomerules ..... 4
3. Upper panicle branches always with subtending bracts; pappus less than 2 x as long as cypsela ..... Eremanthus (2 spp.)
- + Upper panicle branches without subtending bracts; pappus nearly 3 x as long as cypsela ..... Vanillosmopsis (1 sp.)
4. Capitula in sessile axillary groups ..... Piptocarpha (1 sp.)
- + Capitula in terminal panicles ..... 5
5. Panicle wide, divaricately branched, with one-sided scorpioid branches bearing sessile capitula; involucre bracts green with scarious margins ..... Vernonia (1 sp.)
- (V. ferruginea)
- + Panicle more racemosely branched; involucre bracts entirely scarious ..... Moquinia (1 sp.)

### Connaraceae

- 1. Fruit stipitate; calyx not accrescent; carpels 1 or 5 .. Connarus (2 spp.)
- + Fruit sessile; calyx accrescent; carpels 5 ..... Rourea (2 spp.)

### Dilleniaceae

- 1. Petals white; sepals subequal ..... Curatella (1 sp.)
- + Petals yellow; sepals very unequal, the two internal cup-shaped and much larger than the outer ..... Davilla (5 spp.)

### Ebenaceae

- 1. Perianth 4-to 6-merous ..... Diospyros (2 spp.)
- + Perianth 3-merous ..... Maba (1 sp.)

### Flacourtiaceae

- 1. Stamens 10-15; flowers less than 15 mm in diameter ..... Casearia (3 spp.)
- + Stamens 25-30; flowers 15-30 mm in diameter ..... Ryania (1 sp.)

### Guttiferae

(Kielmeyera is also included in the Ternstroemiaceae)

- 1. Leaves alternate; style 1; seeds winged ..... Kielmeyera (5 spp.)
- + Leaves opposite; styles more than 1, or stigmas sessile; seeds not winged ..... 2
- 2. Flowers hermaphrodite; stamens arranged in fused (hypericoid) bundles; styles 5; leaves and floral parts glandular-punctate ..... Vismia (2 spp.)
- + Flowers unisexual (sometimes appearing hermaphrodite because of the presence of staminodes); stamens many, free or united below into a crown, not arranged in bundles; stigmas sessile or almost sessile; leaves and floral parts not glandular-punctate ..... Clusia (2 spp.)



# Euphorbiaceae

1. Leaves 3-to many-lobed ..... 2
- + Leaves simple and undivided (sometimes with serrate margins) .. 3
  
2. Inflorescence a dichotomous cyme; leaves palmatifid or oak-like with acute spiny teeth along margins; stinging hairs sometimes present; perianths less than 1.5 cm long ..... Jatropha (2 spp.)
- + Inflorescence racemose; leaves usually almost ternate, margins entire; stinging hairs absent; perianths usually more than 1.5 cm long ..... Manihot (4 spp.)
  
3. Plants dioecious; both male and female flowers borne in small globose involucre; plant with lepidote or stellate indumentum ..... Pera (1 sp.)
- + Plants monoecious; inflorescence generally with a few female flowers below and male flowers above, but sometimes female flowers throughout the inflorescence; flowers not borne in small globose involucre; lepidote or stellate indumentum present or not ..... 4
  
4. Indumentum of stellate hairs or peltate scales present (usually very obvious on leaves, inflorescence and flowers) ..... Croton
- + Indumentum not as above ..... 5
  
5. Leaves broadly ovate, entire, petiolate; male flowers massed to form a compact inflorescence little longer than broad; staminal filaments often fused ..... Maprounea (2 spp.)
- + Leaves without the above combination of characters; male flowers in a panicle or spike much longer than broad; staminal filaments free ..... 6
  
6. Leaves elliptic, lanceolate-acuminate; flowers orange; male part of the inflorescence a panicle; male 'flowers' consisting of a globular mass of many stamens inserted on a hemispherical receptacle, anthers almost sessile; female flowers large with a united styler column 1 cm or more long ..... Mabea (1 sp.)
- + Leaves never acuminate; male part of the inflorescence a spike or spicate panicle; male flowers with 2-3 stamens and well-developed filaments; female flowers with styles free or connate only to form a very short styler column ..... 7
  
7. Bracts biglandular; calyx bilobed; leaves with 2-4 glands at the base of the lamina or at the apex of the petiole ..... Sapium (2 spp.)
- + Bracts eglandular; calyx 3-partite; leaves without glands at the base of the lamina or at the apex of the petiole ..... Sebastiania (1 sp.)

### Humiriaceae

1. Stamens 50-180; anther loculi bilocellate ..... Vantanea (1 sp.)
- + Stamens 10-20; anther loculi unilocellate ..... 2
2. Anthers bearded; ovary loculi biovulate ..... Humiria (1 sp.)
- + Anthers glabrous; ovary loculi uniovulate ..... Sacoglottis (2 spp.)

### Lauraceae

1. Fertile stamens 3; anthers 2-celled; flowers hermaphrodite;  
fruit without persistent cupule derived from hypanthium;  
leaves sessile, crowded at tips of branches ..... Mezilaurus (2 spp.)
- + Fertile stamens 9; anthers 4-celled; flowers hermaphrodite  
or plants dioecious; hypanthium forming a cupule at the  
base of the fruit ..... 2
2. Flowers usually hermaphrodite; anther cells in one slightly  
arcuate or horizontal row ..... Nectandra (2 spp.)
- + Flowers usually unisexual; anther cells in two  
vertical rows ..... Ocotea (5 spp.)

### Loganiaceae

1. Lower part of each flower invested by a multipartite  
imbricate involucre; seeds winged ..... Antonia (1 sp.)
- + Flowers without such involucre; seeds unwinged ..... Strychnos (3 spp.)

### Lythraceae

1. Flowers 6-merous; small slender shrubs ..... Diplusodon
- + Flowers 8- to 16-merous; trees or larger shrubs ..... 2
2. Petals cream ..... Lafoensia (3 spp.)
- + Petals rose-purple ..... Physocallyma (1 sp.)

Leguminosae

Mimosoideae

1. Stamens many, or if only twice the number of the petals  
then fused below to form a tube ..... 2
- + Stamens twice the number of the petals or fewer;  
always free ..... 7
2. Pollen aggregated into 2-6 masses in each pollen sac;  
inflorescences various; stamens usually many, sometimes 10 .... 3
- + Pollen not aggregated into masses; inflorescence a large,  
long-stalked, flat or round head; stamens 10 ..... Parkia (1 sp.)
3. Stamens free ..... Acacia (1 sp.)
- + Staminal filaments fused below to form a tube  
(sometimes rather short) ..... 4
4. Leaves pinnate ..... Inga (2 spp.)
- + Leaves bipinnate ..... 5
5. Small shrubs, not exceeding 1.5 m; pod straight, thickened  
at the margins. .... Calliandra (2 spp.)
- + Trees or shrubs exceeding 1.5 m; pod often twisted or  
horseshoe-shaped ..... 6
6. Legume horseshoe-shaped or further coiled in a plane spiral,  
with the stalk inserted part way along the inner  
surface ..... Enterolobium (3 spp.)
- + Legume various but with stalk terminal ..... Pithecolobium (3 spp.)
7. Fruit a flat lomentum, with persistent thickened margins .. Mimosa (4 spp.)
- + Fruits not as above ..... 8
9. Pinnules tiny, opposite ..... Piptadenia (2 spp.)
- + Pinnules 1-2 cm, alternate ..... 9
9. Fruit much compressed ..... Plathymenia (1 sp.)
- + Fruit not compressed ..... Stryphnodendron (5 spp.)



Leguminosae  
Caesalpinoideae

(From family key Swartzia (3 spp.))

1. Corolla absent or represented by 1 or 2 small petals;  
fruits short, 1-seeded ..... 2
- + Corolla of 5 petals present; fruits usually more  
than 1-seeded ..... 3
  
2. Sepals 4; stamens 8 or 10; seed arillate; leaves  
paripinnate ..... Copaifera (5 spp.)
- + Sepals 5; stamens 2; seed not arillate; leaves  
imparipinnate ..... Dialium (1 sp.)
  
3. Leaves bifoliolate, or simple & bilobed, bifid or  
rarely with an entire tip ..... 4
- + Leaves compound, pinnate or bipinnate ..... 6
  
4. Leaves simple, bilobed or rarely entire, or if bifoliolate  
legume many-seeded and not woody and indehiscent;  
inflorescence not appearing articulated ..... Bauhinia (6 spp.)
- + Leaves always bifoliolate; legume not as above;  
inflorescence with an articulated appearance ..... 5
  
5. Legume short, flat, usually 1-seeded, dehiscing by  
2 valves ..... Peltogyne (1 sp.)
- + Legume very thick, often massive, woody, indehiscent,  
frequently exuding gum from cracks in the pericarp ..... Hymenaea (3 spp.)
  
6. Leaves bipinnate; androecium of 5 fertile stamens  
opposite the petals alternating with 5 staminodes .... Dimorphandra  
(Sometimes placed in  
Mimosoideae). (2 spp.)
- + Leaves pinnate; androecium not as above ..... 7
  
7. Individual flowers small, not or hardly exceeding 1 cm in  
diameter, almost actinomorphic, in dense panicles ..... 8
- + Individual flowers exceeding 1 cm in diameter,  
conspicuous, <sup>+</sup> obviously zygomorphic ..... 11
  
8. Leaves imparipinnate; leaflets equal at the base;  
staminal filaments glabrous ..... 9
- + Leaves usually paripinnate; leaflets oblique and often  
conspicuously unequal at the base; staminal filaments  
often very hairy ..... 10
  
9. Leaflets alternate; petals linear; fruit a samara with  
linear median seed extending for most of its length .... Myrocarpus  
(Papilionatae) (1 sp.)
- + Leaflets opposite or subopposite; petals somewhat  
expanded; fruit flattened, seed or seeds  
circular in outline ..... Sweetia (Acosmium)  
(Papilionatae) (5 spp.)



10. Petals linear or ovate; legume flat, indehiscent;  
seeds flat, unwinged ..... Sclerolobium (3 spp.)
- + Petals ovate, never linear; legume flat, bivalved;  
seeds winged..... Diptychandra (3 spp.)
11. Stamens 10, monomorphic; anthers versatile, dehiscing  
by lateral slits, much shorter than the filaments ..... Cenostigma (1 sp.)
- + Stamens 10 or fewer, frequently dimorphic; anthers  
biporose, basifixed, usually much exceeding the  
filaments in length ..... Cassia (9 spp.)

Leguminosae

Papilionatae

(From Caesalpinoideae key Myrocarpus (1 sp.), Sweetia (5 spp.))

1. Tree flowering when leafless, covered in orange to scarlet flowers with short wing petals less than one third the length of the keel; seeds bean-like, scarlet ..... Erythrina (3 spp.)  
+ Not as above ..... 2
2. Leaves unifoliolate (apparently simple) or trifoliolate ..... 3  
+ Leaves pinnate with more than three leaflets ..... 7
3. Leaves unifoliolate, often with stipules forming wings on the stem, or trifoliolate; anthers dimorphic ..... Crotalaria  
+ Leaves trifoliolate; anthers monomorphic ..... 4
4. Wing petals less than one third the length of the keel; keel conspicuously incurved; petals usually orange to scarlet ..... Erythrina (3 spp.)  
+ Not with the above combination of characters ..... 5
5. Calyx glabrous within ..... Collaea (1 sp.)  
+ Calyx sericeous within ..... 6
6. Legume stipitate ..... Camptosema (3 spp.)  
+ Legume sessile ..... Dioclea (1 sp.)
7. Stamens free ..... 8  
+ Staminal filaments united ..... 9
8. Corolla yellow, subpapilionate, with a broad posterior standard and the other 4 petals narrowly oblong and subequal; legume indehiscent, with 1 basal seed and the upper portion forming a wing ..... Ferreireia (1 sp.)  
+ Corolla blue-purple, papilionate; legume indehiscent, flat, many-seeded ..... Bowdichia (2 spp.)
9. Calyx forming two elongate, entire lips in antero-posterior plane; androecium monadelphous with long and short anthers alternating ..... Harpalyce (1 sp.)  
+ Calyx not as above; anthers monomorphic ..... 10
10. Fruit a disarticulating lomentum, conspicuously constricted between each seed ..... Aeschynomene (1 sp.)  
+ Fruit not a lomentum ..... 11

11. The two posterior sepals developed to form 2 lateral (Polygala-like) wings; the 3 other sepals small and inconspicuous; fruit a woody drupe, compressed or not ..... 12
- + Sepals not polygaliform; fruit drupaceous or not ..... 13
  
12. Drupe very woody, nut-like (resembling an almond), unwinged, very aromatic; leaf rachis winged, leaflets 10-11, 5-8 cm long with asymmetrical bases; wing sepals green, petals cream (standard with a violet spot) ..... Dipteryx (1 sp.)
- + Drupe much compressed, pericarp  $\pm$  extended into a wing around the seed; rachis unwinged, leaflets much more numerous, 2-4 cm long without strikingly asymmetrical bases; flowers deep purple, blue, lilac, pale pink or white ..... Pterodon (2 spp.)
  
13. Fruit a globose or ovoid drupe ..... Andira (5 spp.)
- + Fruit not as above ..... 14
  
14. Fruit a 1-seeded samara with the seed at one end ..... 15
- + Fruit 1 or more seeded; if winged then the seed  $\pm$  central ..... 18
  
15. Seed distal (furthest from stalk), lower part of fruit developed as a wing ..... Platypodium (2 spp.)
- + Seed proximal (nearest to stalk), upper part of fruit developed as a wing ..... 16
  
16. Pericarp covering seed bearing rigid hairs ..... Centrolobium (1 sp.)
- + Pericarp covering seed without such hairs ..... 17
  
17. Petals yellow, glabrous ..... Tipuana (1 sp.)
- + Petals greenish-black, violaceous, or dirty-white, standard pilose or sericeous on the back ..... Machaerium (7 spp.)
  
18. Leaflets opposite ..... Lonchocarpus (2 spp.)
- + Leaflets alternate, or if subopposite then greyish in colour, often with scattered black spots and standard petal blackish violet ..... 19
  
19. Flowers  $\pm$  15 mm long, bright orange-yellow; fruit almost circular in outline with the wing surrounding the seed ..... Pterocarpus (1 sp.)
- + Flowers considerably less than 15 mm long; standard petal blackish violet; fruit elongate with seed in the centre ..... Dalbergia (4 spp.)

# Malpighiaceae

(by Dr Bronwyn Gates, apart from a modification to include Tetrapterys)

1. Fertile stamens 5; staminodes frequently present ..... 2
- + Fertile stamens 10 ..... 3
  
2. Five conspicuous staminodes present; large, fused,  
Rubiaceae-like, interpetiolar stipules present ..... Peixotoa
- + Staminodes absent; interpetiolar stipules minute,  
not fused ..... Schwannia
  
3. Fruiting pericarp unwinged; calyx with either  
10 or no glands ..... 4
- + Fruiting pericarp winged (fruit a group of  
samaras); calyx usually with 8 glands ..... 5
  
4. Calyx bearing 10 glands ..... Byrsonima (10 spp.)
- + Calyx eglandular ..... Galphimia (1 sp.)
  
5. Each samara with 4 wings ..... Tetrapterys
- + Each samara with only a single wing ..... 6
  
6. Samaras with wings encircling the loculi ..... Mascagnia (1 sp.)
- + Samaras with dorsal wings (often resembling Acer  
fruits and the group - like the blades of an  
aircraft propeller) ..... 7
  
7. Upper margin of samara-wing thickened; stigmas  
capitate; pedicel with bracteoles only at the  
base, not articulated ..... Banisteriopsis (2 spp.)
- + Lower margin of samara-wing thickened; stigmatic  
surfaces excentric, borne towards the inside of  
the flower; pedicel bearing a pair of  
bracteoles, articulated at the point of their  
insertion ..... Heteropterys



### Melastomataceae

1. Leaves unicostate; perianth parts in fives ..... Mouriria (2 spp.)
- + Leaves multicostate, or if apparently unicostate  
perianth parts in fours ..... 2
2. Perianth parts in fours; connective developed  
into a conspicuous, sterile, often arcuate  
structure below the anther; stamens often  
sickle-shaped ..... 3
- + Perianth parts usually in fives; connective not  
as above; stamens never sickle-shaped ..... 4
3. Apex of ovary setose ..... Macairea (3 spp.)
- + Apex of ovary glaberrimous, never setose ..... Comolia (1 sp.)
4. Petals obtuse; calyx segments obtuse, small,  
inconspicuous or none ..... Miconia (11 spp.)
- + Petals acute; calyx segments acute ..... Leandra (2 spp.)

### Meliaceae

1. Stamens free, borne on a short androgynophore  
(which does not exceed the petals), filaments  
not flattened; ovules 8-12 per loculus; seeds  
winged ..... Cedrela (1 sp.)
- + Stamens monadelphous, or if free the filaments  
flattened and wider than the anther, not borne  
on an androgynophore; ovules 1-2 per loculus;  
seeds unwinged ..... 2
2. Anthers borne on the inner surface of the  
'corona'; disc forming a tube surrounding the  
ovary ..... Cabralea (1 sp.)
- + Anthers borne at the apex of the 'corona', or  
on flattened separate filaments which are  
usually fused below; disc stipitiform or absent ..... Trichilia (2 spp.)

### Moraceae

1. Flowers all lining the inside of a hollow fleshy  
receptacle ..... Ficus (? spp.)
- + Female flower immersed in a receptacle, the  
surface of which is covered in very reduced male  
flowers ..... Brosimum (1 sp.)

Myrsinaceae

1. Flowers in simple or compound racemes with long peduncles; anthers not apiculate ..... Cybianthus (2 spp.)  
(incl. Weigeltia)
- + Flowers in axillary umbellate clusters; anthers apiculate ..... Myrsine (3 spp.)  
(incl. Rapanea)

Myrtaceae

1. Calyx limb united in the bud, bursting irregularly at anthesis ..... Psidium (4 spp.)
- + Calyx limb 4- or 5-lobed in the bud ..... 2
2. Calyx lobes 5; ovary bilocular with 2 ovules per loculus or multilocular with many ovules per loculus ..... 3
- + Calyx lobes 4; ovary bilocular with more than 2 ovules per loculus ..... 4
3. Flowers in panicles, inflorescence with obvious peduncles; ovary bilocular with 2 ovules per loculus ..... Myrcia (8 spp.)
- + Flowers solitary in the axils of leaves, although sometimes much aggregated on short small-bracted shoots; ovary multilocular with many ovules per loculus ..... Campomanesia (5 spp.)
4. Receptacle produced above the ovary ..... Myrciaria (2 spp.)
- + Receptacle not produced above the ovary ..... Eugenia (9 spp.)

Nyctaginaceae

1. Stamens included in the perianth tube; stigma simple, not lacinate ..... Neea (1 spp.)
- + Stamens exserted; stigma with a conspicuous terminal tuft of hairs, or lacinate ..... Pisonia (5 spp.)

Olacaceae

(Schoepfia from family key)

1. Corolla sympetalous with reflexed lobes ..... Schoepfia (1 sp.)  
+ Corolla polypetalous ..... 2
2. Petals bearing a dense indumentum for most or all  
the length of the inner surface; calyx little or  
not accrescent in fruit ..... Ximenia (2 spp.)  
+ Indumentum on inner surface of petals confined  
to a tuft about the middle of their length; calyx  
accrescent to form a broad wing in fruit ..... Heisteria (1 sp.)

Proteaceae

1. Leaves simple, pinnatifid, pinnatisect or  
imparipinnate ..... Roupala { 7 spp. }  
+ Leaves paripinnate, usually with a terminal 'bud' ..... Euplassa { 2 spp. }

Rhamnaceae

1. Plant spiny; leaves 3-nerved (multicostate) ..... Zizyphus { 1 sp. }  
+ Plant unarmed; leaves penninerved (unicostate) ..... Rhamnidium { 1 sp. }

# Rubiaceae

1. Plant bearing strong axillary spines ..... 2
- + Plant unarmed ..... 3
  
2. Perianth 5-merous ..... Machaonia (1 sp.)
- + Perianth 4-merous ..... Chomelia (3 spp.)
  
3. Low undershrub with leaves pale-fawn tomentose below; flowers in tight axillary whorls; calyces densely lanate; fruit fleshy, pink, edible ..... Sabicea (1 sp.)
- + Not with the above combination of characters ..... 4
  
4. Ovules one per loculus ..... 5
- + Ovules many per loculus, or flowers male ..... 9
  
5. Ovary 4-6-locular; calyx truncate ..... Guettarda (1 sp.)
- + Ovary bilocular; calyx deeply lobed or sepals free ..... 6
  
6. Stamens epigynous ..... Chiococca (1 sp.)
- + Stamens epipetalous ..... 7
  
7. Stamens inserted some distance below the mouth of the corolla tube and included in the tube; leaves very rigid ..... Palicourea (2 spp.)
- + Stamens inserted at or near the mouth of the corolla tube, anthers exserted or not; leaves not notably rigid ..... 8
  
8. Filaments much shorter than the anthers; anthers little exserted; corolla conspicuously yellow; plant often flowering when leafless or with only very young foliage present ..... Chomelia (1 sp.)
- + Filaments as long, or longer than the anthers; anthers exserted; corolla cream; leaf venation much impressed on upper surface ..... Rudgea (1 sp.)
  
9. Fruit a capsule; seeds winged ..... 10
- + Fruit indehiscent, often a berry; seeds not winged, or flowers male ..... 11
  
10. Calyx and corolla 5, hispid, corolla pinkish; stamens included in the corolla tube; capsule valves bifid; veins on lower surface of leaf hispid ..... Remijia (1 sp.)
- + Calyx and corolla 4, glabrous, corolla yellow-cream; stamens exserted; capsule valves entire; veins on lower surface of leaf glabrous ..... Ferdinandusa (1 sp.)
  
11. Flowers hermaphrodite ..... 12
- + Flowers unisexual; sometimes with vestigial organs of the other sex present ..... Alibertia (incl. Thielodoxa) (4 spp.)



12. Corolla 1.5-2 cm long; stamens included in the tube; berry less than 1 cm, somewhat fleshy, nerves prominent between sulci ..... Hamelia (1 sp.)
- + Corolla with long slender tube, 7-17 cm long; stamens exserted; berry more than 1 cm, fleshy, surface smooth (not sulcate) ..... 13
13. Corolla lobes narrowly oblong, strongly reflexed; fruit golden; corolla and lower surface of leaves glabrous ..... Posoqueria (1 sp.)
- + Corolla lobes - broadly ovate, never strongly reflexed; fruit blackish; corolla and lower surface of leaves densely villous or not ..... Tocoyena (2 spp.)

### Rosaceae

(Including Chrysobalanaceae)

(Modif. from Prance, Fl. Neotropica)

1. Ovary inserted at or near the base of the receptacle ..... 2
- + Ovary inserted at or near the mouth of the receptacle ..... 3
2. Style lateral; inflorescence a panicle ..... Licania (incl. Moquilea) (2 spp.)
- + Style terminal; inflorescence a simple raceme ..... Prunus (1 sp.)
3. Stamens about as long as the petals; suffrutex or very small shrub ..... Parinari (1 sp.)
- + Stamens much exceeding the petals; larger shrub or tree ..... 4
4. Stamens 50-125; fruit with no lines of dehiscence, endocarp thick and often fragile ..... Couepia (1 sp.)
- + Stamens 10 or less; fruit opening by longitudinal lines of weakness, endocarp hard and thin ..... Hirtella (3 spp.)

Rutaceae

(Fagara from family key)

1. Leaves simple ..... Hortia (1 sp.)
- + Leaves compound ..... 2
2. Leaves trifoliolate; flowers hermaphrodite ..... 3
- + Leaves pinnate; flowers unisexual ..... Fagara (3 spp.)
3. Flowers showy; petals 20—30 mm long ..... Spiranthera (1 sp.)
- + Flowers small; petals 2—3 mm long ..... Esenbeckia (1 sp.)

Sapindaceae

1. Leaves bipinnate (with regularly serrate leaflets);  
inflorescence without tendrils; fruit an elliptical  
trigynous capsule ..... Dilodendron (1 sp.)
- + Leaves ternate, pinnate or biternate, or if  
bipinnate then plant a slender-stemmed shrub  
with tendrils in the inflorescence and fruit a  
winged schizocarp ..... 2
2. Leaves ternate, no tendrils present; fruit of 3  
unwinged cocci (or 2 or 1 by abortion) ..... Allophyllus (1 sp.)
- + Leaves not ternate; tendrils present or not;  
fruit a capsule or winged schizocarp ..... 3
3. Fruit a winged schizocarp (tricoccous) ..... 4
- + Fruit a capsule, often deeply lobed ..... 5
4. Plant with tendrils, at least in the inflorescence,  
often climbing; leaves pinnate, biternate or  
bipinnate (if pinnate then rachis winged) ..... Serjania (? spp.)
- + Plant without tendrils, erect; leaves pinnate  
with unwinged rachis ..... Toulicia (1 sp.)
5. Petals linear (strap-like), green outside and  
atropurpureous within; loculi multiovulate; fruit  
a massive woody capsule, 6—7 x 8—10 cm, containing  
many large flat seeds ..... Magonia (1 sp.)
- + Petals not as above; loculi uniovulate; capsules  
1—2.5 cm long, containing a single arillate  
unflattened seed per loculus ..... 6
6. Calyx cup-shaped, 5-lobed ..... Matayba (2 spp.)
- + Sepals free, broadly imbricate ..... Cupania (2 spp.)

Simarubaceae

(Dictyoloma and Simaruba from the family keys, the former is  
often considered a member of the Rutaceae)

1. Flowers polygamous; stamens the same number  
as petals; many seeds per carpel (loculus);  
fruit a group of follicles; seeds winged ..... Dictyoloma (1 sp.)
- + Flowers hermaphrodite or plant dioecious;  
stamens twice the number of petals; fruit  
simple 1-seeded, indehiscent; seeds  
unwinged ..... 2
2. Flowers hermaphrodite; petals valvate ..... Simaba (2 spp.)
- + Flowers dioecious; petals imbricate ..... Simaruba (1 sp.)

Sterculiaceae

1. Flowers with a long androgynophore; fruit  
spiral ..... Helicteres (3 spp.)
- + Flowers without a long androgynophore;  
fruit straight ..... 2
2. Petals concave and bearing a long forked  
appendage terminally; staminal filaments  
fused below, terminating in 5 branches each  
bearing a cluster of 3 anthers; capsule  
spiny or tuberculate ..... Guazuma (1 sp.)
- + Petals and androecium not as above; fruit  
hirsute or tomentose but never spiny or  
tuberculate ..... 3
3. Ovary 5-locular; stigmas 5 ..... Melochia (1 sp.)
- + Ovary unilocular; stigma 1 ..... Waltheria (1 sp.)

Styracaceae

1. Stamens 10 ..... Styrax (3 spp.)
- + Stamens 5 ..... Pamphilia (1 sp.)

Ternstroemiaceae

(Kielmeyera more usually placed in Guttiferae)

1. Styles free; perianth not clearly differentiated into calyx and corolla but members increasing in size from below upwards, polytepalous ..... Laplacea (2 spp.)
- + Style single (united); perianth differentiated into calyx and corolla, the latter often sympetalous ..... 2
2. Some sepals deeply glandular dentate; tips of stamens apiculate; seeds unwinged ..... Ternstroemia (1 sp.)
- + Sepals entire; stamens not apiculate; seeds winged ..... Kielmeyera (5 spp.)

Tiliaceae

1. Flowers 7 mm in length or less, in panicles, unisexual (polygamous) but with vestigial organs of the other sex always present; sepals and petals 4, reflexed; ovary bilocular with 2 stigmas; fruit 3-4 mm long, compressed, fringed with long plumose hairs ..... Heliocarpus (1 sp.)
- + Flowers at least 1 cm in length and usually much more, hermaphrodite; petals and sepals 5, not reflexed; ovary 5-multilocular; fruit larger than above, not compressed ..... 2
2. Epicalyx absent; capsule depressed-globose, + 7.5 cm in diam and 4 cm high, densely spiny and tomentose ('pente de macaco') ..... Apeiba (1 sp.)
- + Epicalyx present; capsule ovate-oblong or oblong, 2-5 cm long, woody, glabrous or short tomentose ..... Luhea (4 spp.)



### Verbenaceae

1. Leaves palmately compound ..... Vitex (3 spp.)  
+ Leaves simple ..... 2
2. Inflorescence cymose; flowers often  
unisexual; stamens of male flowers  
and styles of female flowers exserted ..... Aegiphila (4 spp.)  
+ Inflorescence racemose; flowers  
hermaphrodite; stamens and styles  
included in corolla tube ..... 3
3. Inflorescence diffuse; fruiting calyx  
winged; fruit a capsule ..... Petreaea (1 sp.)  
+ Inflorescence compact; fruiting calyx  
unwinged; fruit fleshy ..... Lantana (1 sp.)

### Vochysiaceae

(Modif. from Stafleu, Fl. Suriname)

1. Petals 5, subequal; calyx lobes  
subequal, as long as the flower bud ..... Salvertia (1 sp.)  
+ Petals 1-3, unequal; calyx lobes  
unequal, only the 4th (usually  
spurred) lobe as long as the flower bud ..... 2
2. Two ovules per loculus; petals usually  
3, rarely 1 or 0; stamen alternating  
with the 5th and 3rd calyx lobes ..... Vochysia (7 spp.)  
+ Many ovules per loculus; petals  
usually 1, rarely 2; stamen inserted on  
the calyx in front of the 5th lobe ..... 3
3. Capsule with a thick persistent central  
column; exocarp fragile, separating in  
irregular fragments from the endocarp ..... Callisthene (4 spp.)  
+ Central column slender or absent  
(usually breaking away with the valves);  
exocarp thick woody, adhering to the  
thinner endocarp ..... Qualea (7 spp.)

The following families are represented by single genera.  
Number of species are given in the brackets.

- Aquifoliaceae: Ilex (3)  
Boraginaceae: Cordia (1)  
Burseraceae: Protium (2)  
Capparidaceae: Capparis (2)  
Caryocaraceae: Caryocar (2)  
Celastraceae: Plenckia (1)  
Cochlospermaceae: Cochlospermum (1)  
Clethraceae: Clethra (1)  
Erythroxylaceae: Erythroxylum (6)  
Hippocrateaceae: Salacia (3)  
Icacinaceae: Emmotum (1)  
Labiatae: Hyptis (1)  
Lecythidaceae: Lecythis (?)  
Myristicaceae: Virola (2)  
Ochnaceae: Ouratea (6)  
Opiliaceae: Agonandra (1)  
Oxalidaceae: Oxalis (1)  
Polygalaceae: Bredmeyeria (1)  
Sapotaceae: Pouteria (3)  
Solanaceae: Solanum (1)  
Symplocaceae: Symplocos (3)  
Trigoniaceae: Trigonia (1)  
Vitaceae: Cissus (3)  
Winteraceae: Drimys (1)

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## APPENDIX 2

### Vernacular names of some of the species of Fazenda Agua Limpa

- Açaí: Euterpe sp., Geonoma schottiana (Palm.)  
Açoito cavalo: Luhea paniculata (Tili.)  
Almécega: Protium spp. (Burser.)  
Amarelão: Apuleia molaris (Leg., Caes.)  
Amargozinha: Sweetia dasycarpa (Leg., Pap.)  
Ameixa brava: Myrtaceae sp.  
Angarana: Sclerolobium paniculatum (Leg., Caes.)  
Angazinho: " " " "  
Angelim: Andira paniculata, Andira sp. (Leg., Pap.)  
Angico preto: Piptadenia falcata (Leg., Mim.)  
Araçá: Myrtaceae sp.  
Araçá da mata: Myrcia cf. deflexa (Myrt.)  
Aráticum: Annona crassiflora (Annon.)  
Aroeirana: Astronium fraxinifolium (Anacard.)  
Ata brava: Talauma ovata (Magnol.)  
Assa peixe: Vernonia ferruginea (Comp.)
- Bacopari do cerrado: Salacia crassifolia (Hippocrat.)  
Bacopari vermelho: Salacia elliptica (Hippocrat.)  
Barbatimão: Stryphnodendron barbatimao (Leg., Mim.)  
Bate caixa: Palicourea rigida (Rub.)  
Bolsinha: Aspidosperma macrocarpon, A. tomentosum (Apoc.)  
Bosta de rato: Hirtella glandulosa (Chrysobal.)  
Breu: Protium spp. (Burser.)  
Breu rasteiro: Protium ovatum (Burser.)  
Brinco da agua: Ferdinandusa speciosa (Rub.)  
Bugre: Rudgea viburnioides (Rub.)  
Buriti: Mauritia flexuosa (Palm.)  
Buxa da mata: Gurania spinulosa (Cucurb.)



Cabeça de negro: Bulbostylis paradoxa (Cyper.); Ouratea acuminata (Ochn.)  
 Cabecinha de negro: Bulbostylis emmerichiae (Cyper.)  
 Cafezinho: Rapanea guyanensis (Myrsin.)  
 Caju rasteiro: Anacardium curatellifolium (Anacard.)  
 Cancileiro: Machaerium acutifolium, Platypodium grandiflorum (Leg., Pap.)  
 Canela de ema: Vellozia squamata (Velloz.)  
 Canela de jacomí: Ruellia sp. (Acanth.)  
 Canela de velha: Aspidosperma sp. (Apoc.)  
 Cangerana vermelha: Vochysia pyramidalis (Voch.)  
 Capim bengó: Panicum sp. (Gram.)  
 Capim gordura: Melinis minutiflora (Gram.)  
 Capim navalha: Scleria arundinacea (Cyper.)  
 Capim trigo: Olyra latifolia (Gram.)  
 Capitão de cerrado: Terminalia argentea, T. spp. (Combret.)  
 Caraíba: Tabebuia caraiba (Bignon.)  
 Caripé: Licania sp. (Chrysobal.)  
 Carobinha: Jacaranda caroba (Bignon.)  
 Carvoeiro: Sclerolobium aureum (Leg., Caes.)  
 Catoaba: Anemopaegma glaucum (Bignon.)  
 Cedro: Cedrela odorata, Cabralea canjerana (Meli.)  
 Cinco dedos: Zehyera digitalis (Bignon.)  
 Cipó costela de anta: Coccoloba sp. (Polygon.)  
 Cipó cururú: Serjania spp. (Sapind.)  
 Cipó de fogo: Davilla nitida (Dillen.)  
 Cipó japecanga: Smilax syringoides (Lil.)  
 Cipó prata: Piptocarpha aff. oblongae (Comp.)  
 Cipó rabo de camaleão: Leguminosae sp.  
 Copaíba: Copaifera langsdorfii (Leg., Caes.)  
 Coquinho: Allagoptera (Diplothemium) leucocalyx (Palm.)  
 Coração de negro: Connarus fulvus (Connar.); Eremanthus glomerulatus (Comp.);  
Piptocarpha macropoda (Comp.)  
 Criolim: Mouriri aff. glazioviana (Melast.)  
 Crista de galo: Heliotropium indicum (Borag.)  
 Curiola: Pouteria ramiflora, P. torta (Sapot.)  
  
 Douradinha: Rudgea viburnioides (Rub.)

Embireira: Guatteria sellowii, G. sp. (Annon.)

Embiraçú: Bombax tomentosum (Bombac.)

Farinha seca: Lauraceae sp.

Faveira: Dimorphandra mollis (Leg., Mim.)

Figo: Ficus spp. (Mor.)

Folha miuda: Myrtaceae sp.

Fruta de conde: Talauma ovata (Magnol.)

Fruta de ema: Parinari obtusifolia (Chrysobal.)

Fruta de morcego: Euplassa inaequalis, Roupala montana (Prot.)

Gameleirinha: Ficus sp. (Morac.)

Gariroba: Syagrus comosa (Palm.)

Garote: Terminalia argentea, T. spp. (Combret.)

Genipapo bravo: Tocoyena formosa (Rub.)

Gervão: Stachytarpheta polyura (Verb.)

Goiaba brava: Myrtaceae spp.

Goiabinha: Myrcia cf. tomentosa, M. sp. (Myrt.)

Gomeira: Vochysia thyrsoidea (Voch.)

Gonçalo Alves: Astronium fraxinifolium (Anacard.)

Grão de galo: Pouteria ramiflora, P. torta (Sapot.)

Gravata: Dyckea spp. (Bromel.)

Guatambu: Aspidosperma sp. (Apoc.)

Imbaúba: Cecropia sp. (Morac.)

Inga: Inga alba, Inga sp. (Leg., Mim.)

Inharê: Sorocea sp. (Morac.)

Inharezinho: Brosimum gaudichaudii (Morac.)

Ipe amarelo: Tabebuia sp. (Bignon.)

Jaca brava: Richeria obovata (Euphorb.)  
Jacarandá muchiba: Machaerium angustifolium, M. opacum (Leg., Pap.)  
Jacarandá preta: Dalbergia violacea (Leg., Pap.)  
Jacaré: Qualea dichotoma (Voch.)  
Japacanga: Smilax brasiliensis (Lil.)  
Jasmim do campo: Peschiera affinis (Apoc.)  
Jatobá do cerrado: Hymenaea martiana (Leg., Caes.)  
Jatobá da mata: Hymenaea stilbocarpa (Leg., Caes.)  
João leite: Euphorbia geniculata, E. sp. (Euphorb.)  
Jua mole: Neea theifera (Nyctag.)

Landim: Calophyllum brasiliense (Gutt.)  
Larga galha: Pseudolmedia laevigata (Morac.)  
Leiteira: Sapium obovatum (Euphorb.)  
Licuri: Allagoptera (Diplothemium) leucocalyx (Palm.)  
Lixeira: Curatella americana (Dillen.)  
Lixeirinha: Davilla elliptica (Dillen.)  
Lobeira: Solanum crinitum (Solan.)  
Louro branco: Lauraceae sp.  
Louro pitanga: "  
Louro precioso: "  
Louro vermelho: "

Macambira: Bromelia balansae, B. villosa (Bromel.)  
Macieira: Hyptis cana (Lab.)  
Mama cadela: Brosimum gaudichaudii (Morac.)  
Mama de boto: Asclepiadaceae sp.  
Maminha de porca: Fagara rhoifolia (Rut.)  
Mamonarana: Bombax longiflorum, B. martianum (Bombac.)  
Mangaba brava: Lafoensia pacari (Lythr.)  
Mangabeira: Hancornia speciosa (Apoc.)  
Mandiocão: Didymopanax spp. (Aral.)  
Mandiocão do cerrado: Didymopanax macrocarpum (Aral.)  
Maracujá: Passiflora spp. (Passif.)  
Marfim: Agonandra brasiliensis (Opil.)



Maria preta: Eugenia cf. gamaeana (Myrt.)  
 Maria mole: Ferdinandusa elliptica (Rub.); Pisonia noxia (Nyctag.)  
 Mariana: Ormosia sp. (Leg., Pap.)  
 Marinheiro: Guarea tuberculata (Meli.)  
 Marmelada brava: Amaioua guianensis (Rub.)  
 Marmelo: Plenckia populnea (Celast.)  
 Mata barata: Andira humilis, A. paniculata (Leg., Pap.)  
 Mata barata da mata: Andira sp. (Leg., Pap.)  
 Mata cachorro: Simaruba amara (Simarub.)  
 Mata gado: Palicourea marcgravii (Rub.)  
 Miringiba: Combretaceae sp.  
 Mororó: Bauhinia spp. (Leg., Caes.)  
 Morotó: Didymopanax spp. (Aral.)  
 Muchiba comprida: Erythroxylum tortuosum (Eryth.)  
 Murici: Byrsonima crassa, B. verbascifolia, B. spp. (Malpig.)  
 Murici branco: Byrsonima umbellata (Malpig.)  
 Murici de ema: Byrsonima basiloba (Malpig.)  
 Murici vermelho: Byrsonima coccolobifolia (Malpig.)  
  
 Negramina: Siparuna cuyabana, S. guianensis (Monim.)  
  
 Olho de boi: Diospyros hispida (Eben.)  
 Olho de cotia: Cupania vernalis, Matayba guianensis (Sapind.)  
 Olho de pomba: Casearia grandiflora, C. sylvestris (Flacourt.)  
 Ouricuri: Allagoptera (Diplothemium) leucocalyx (Palm.)  
  
 Paineira: Bombax tomentosum (Bombac.)  
 Pau de arco: Tabebuia sp. (Bigon.)  
 Pau de leite: Himatanthus obovata (Apoc.)  
 Pau de olho: Copaifera langsdorfii (Leg., Caes.)  
 Pau doce: Vochysia elliptica, V. rufa (Voch.)  
 Pau pereira: Aspidosperma cf. pruinsum (Apoc.)  
 Pau santo: Kielmeyera coriacea, K. speciosa (Guttif.)



Pau terra com folhas grandes: Qualea grandiflora (Voch.)  
Pau terra liso: Qualea multiflora (Voch.)  
Pau terra rôxo: Qualea parviflora (Voch.)  
Pau tucano: Vochysia tucanorum (Voch.)  
Pimenta de macaco: Piper sp. (Piper.); Xylopia aromatica (Annon.)  
Pindaíba do brejo: Xylopia emarginata (Annon.)  
Pindaíba preta: Xylopia sericea (Annon.)  
Piquí: Caryocar brasiliense (Caryocar.)  
Piquirana: Belangeria glabra (Cunon.)  
Piririma: Syagrus flexuosa (Mart.) Becc. (Palm.)  
Piririma vassoura: Butia leiospatha (Palm.)

Quaresma: Tibouchina candolleana, T. sp. (Melast.)  
Quina da mata: Aspidosperma sp. (Apoc.)  
Quina do cerrado: Strychnos pseudoquina (Logan.)

Sambaíba: Curatella americana (Dillen.)  
Sambaibinha: Davilla elliptica (Dillen.)  
Sangue de cristo: Sabicea brasiliensis (Rub.)  
Sete sangria: Cambessedesia espora (Melast.)  
Sicupira branca: Pterodon pubescens (Leg., Pap.)  
Sicupira preta: Bowdichia virgilioides (Leg., Pap.)  
Sôbe: Emmotum nitens (Icac.)  
Sucuubinha: Himatanthus obovata (Apoc.)

Taboca de fogo: Ichnanthus bambusiflorus (Gram.)  
Tapicurú: Callisthene major (Voch.)  
Taxi branco: Sclerolobium paniculatum (Leg., Caes.)  
Tento: Ormosia sp. (Leg., Pap.)  
Tingui bosta: Sclerolobium sp. (Leg., Caes.)  
Tiririca do brejo: Scleria arundinacea (Cyper.)

Ubim: Geonoma sp. (Palm.)  
Ucuúba: Virola sebifera, V. urbaniana (Myrist.)  
Urucurana: Alchornea iricurana (Euphorb.)  
Utirana: Couepia grandiflora (Chrysobal.)

Vinhático: Plathymenia reticulata (Leg., Mim.)

Vinhático cascudo: Enterolobium ellipticum (Leg., Mim.)

Xica-xica: Crotalaria spp. (Leg., Pap.)







